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Original Communications.

A *POST-MORTEM* EXAMINATION IN A FATAL CASE OF BULLET WOUND OF THE ABDOMEN.

By G. L. CHEATLE, C.B., F.R.C.S.

ALTHOUGH I had the opportunity of performing the *post mortem* on this case, I did not see the poor fellow alive. The kindness of my friend, Surgeon-Major Sheldrake, who was at the time in command of the Guards' Field Hospital, rendered the examination possible. The results have proved so instructive and rare that I ought to say it was conducted by myself in the presence of Lieutenant-Colonel W. Beevor, R.A.M.C., and Major T. B. Beach, R.A.M.C. We appreciated the importance of the observations made, and were in consequence duly careful. The man died forty-eight hours after being hit, and the examination was conducted two hours after death.

There were two skin wounds. The wound of entrance was just above and a little in front of the highest point of the crest of the ilium on the right side, the bullet (Jeffries' modification of Mauser) was impacted (posterior end pointing outwards and upwards) in the wound of exit at a point in the left flank, which was opposite the wound of entrance, and therefore just above and a little in front of the crest of the ilium on the left side. (See fig. 2.)

The wound of entrance had practically healed under a dry blood clot.

The body was opened up in the usual way. Upon opening the abdomen the main lesion was at once seen beneath the wound of exit. After a few slender adhesions had been gently separated, the upper part of the sigmoid flexure was exposed lying in semi-coagulated blood, septic inflammatory collection, and some extravasated fæces. In the upper part of the sigmoid flexure there were large wounds of entrance and exit, the bullet having passed through the gut in a line transversely to its longitudinal axis, the wounds being somewhat lacerated, and easily admitting my forefinger. (See fig. 1.)

Apart from this focus, no other lesion was very apparent. It seemed impossible for this to be the only effect of a bullet which crossed the abdomen in a transverse direction. Therefore a systematic search for wounds was made of all the abdominal contents. The cæcal wounds were immediately discovered, but there was no adhesion nor focus of inflammation to attract our attention to it, and there was not the least trace of fæcal extravasation. A probe could not be passed into the bowel without force, so the attempt was abandoned. (See fig. 3.) Further than this, no bullet wound could be detected in the intestinal tract and its mesentery. All other organs and viscera were normal. We paid particular attention to exclude any injury to the coils of small intestine, among which we imagined the bullet must have passed; but no sign of a penetrating wound could we detect in the peritoneal and mucous membrane surfaces throughout its entire length.

In one or two places the peritoneal coat was stained in those parts of the ileum near the septic focus around the sigmoid flexure. No alteration in colour, however, could be seen on the mucous membrane internal to these stains. We could not decide whether they were *post-mortem* stains, the result of inflammation connected with the wounded sigmoid flexure, or bruises caused by contact with the bullet. Personally I feel sure no bullet penetrated any part of the small intestine. The man died from the effects of the wounds in the upper part of the sigmoid flexure.

Since my return home, and after showing the cæcum to many surgeons interested in military surgery, I decided to cut sections of its wounds for microscopical purposes. As each wound in the cæcum has a wound of entrance and a wound of exit, I will, for want of a better plan, explain the result of my examination by means of the diagram in fig. 4.

The sections showed that after the bullet left each of the three chief coats of the intestinal wall, the wounds in them occupied differ-

Fig. 1.

Fig. 2.

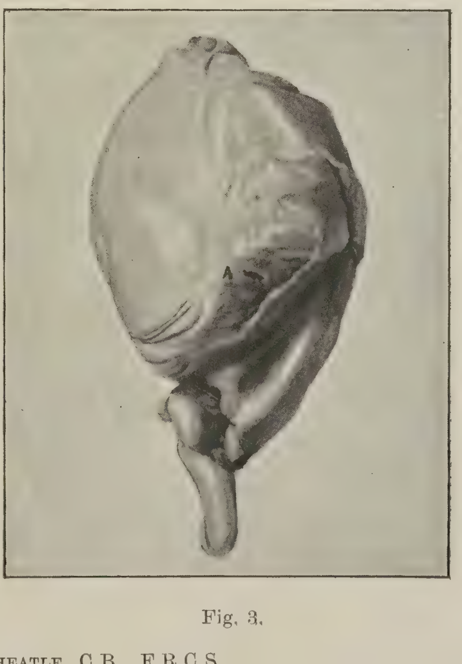

Fig. 3.

Illustrating Article by G. L. Cheatle, C.B., F.R.C.S.

ent planes and also were pulled away laterally from the bullet's line of direction (*a*, *b*, *c*, and *d*, *e*, *f*).

The condition must be explained by the differences in degrees of elasticity between the three chief coats of the intestinal wall, in addition to the power of contraction of its muscular coat. It is therefore impossible to show the complete track of a bullet in one microscopical section when the intestine has received a wound of this kind.

The sections must be cut in series, as we prepared them in this case. In no section was there any sign of prolapse of mucous membrane.

The valvular nature of the wounds is sufficient to explain the absence of fæcal extravasation.

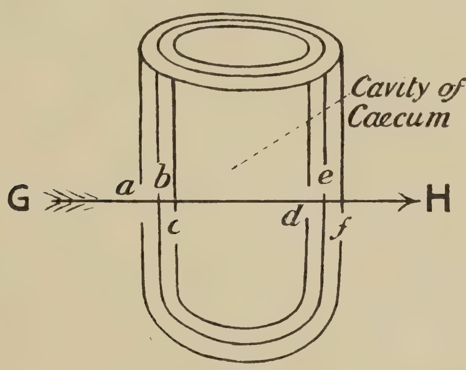

FIG. 4.

FIG. 4.—*a*, *b*, *c*, and *d*, *e*, *f*, represent more or less diagrammatically the positions assumed by the wounds in the peritoneal coat, muscular coat, and mucous membrane, after the bullet passed in the direction G—H.

Macroscopically one can see there was a bigger subperitoneal hæmorrhage in the wound of exit than that of entrance, just as in skin wounds the subcutaneous hæmorrhage of the wound of exit is nearly always greater than that of the wound of entrance.

The case demonstrates :—

(1) That an expanding bullet of low velocity can pass through soft parts without expanding.

(2) That a bullet of low velocity can pass through skin and make a wound which is identical with one caused by a bullet of high velocity.

(3) That a bullet can enter and leave the great intestine and no fæcal extravasation occur.

(4) That a bullet of low velocity may traverse the region presumably occupied by the small intestines, and not penetrate them.

NOTE.—Of the four conclusions which Mr. Cheatle considers are warranted by the *post mortem* on the above case, the three first needed no further proof; they had already been verified by the conditions found in many others. The fourth deduction which Mr. Cheatle makes from it, that it proves to demonstration that a small bore bullet may pass amongst the small intestines without wounding them, is the important matter, and demands criticism if any can properly be passed upon it.

This case has been quoted by every surgeon (myself included) who has written on gunshot wounds of the abdomen since the Boer War began, as proving Mr. Cheatle's fourth conclusion, and at a first glance it would appear to do so. Without further consideration, it would seem to be certain that a bullet which first passed through the cæcum and then through the sigmoid flexure, must have passed amongst the coils of small intestine lying in front of the lower lumbar and upper sacral vertebræ, but careful examination on the dead body shows that this is not the case.

The entrance wound in the skin in Mr. Cheatle's case "was just above and a little in front of the highest point of the crest of the ilium on the right side," and the exit at the corresponding point in the left flank. Now, by the courtesy of the authorities in the *post-mortem* rooms at St. Thomas's and St. Mary's Hospitals, I was given facilities for examining three bodies with regard to this matter, and I found that the line between the entrance and exit apertures in the above case passes through the cæcum and sigmoid flexure, but that the portion of it between the exit in the cæcum and the laceration in the sigmoid does not pass through the peritoneal cavity at all, but through the body of, probably, the last lumbar vertebra extra-peritoneally, and therefore quite clear of the small intestines. Mr. Cheatle's case is, in fact, one of many proving that a small bullet passing through the abdominal cavity wounds all the viscera in its track, rather than one demonstrating that it can traverse the cavity of the abdomen without wounding them; for the bullet penetrated intestine in both situations where the track was intra-peritoneal, and, naturally, failed to do so where it was extra-peritoneal.

All the surgeons present in the two *post-mortem* rooms when I made the examinations agreed with my view as to the track of the bullet and the reason why the small intestines escaped injury, and

Dr. Broadbent, Assistant Pathologist at St. Mary's, permits me to say that he was quite certain that nine-tenths of the bullet track between the cæcum and sigmoid was extra-peritoneal. Moreover, the fact that the bullet had turned over after making normal apertures in the cæcum is a clear indication that it had encountered bone on its way to the exit side.

Some cases of penetrating gunshot wounds of the abdomen seen in the Boer War recovered without developing signs of peritonitis from extravasation, and the prevalent opinion at the present time is that this was owing to the fact that the modern rifle-bullet can traverse the abdomen without wounding the intestines. It is conceivable that this may be true, but there is as yet no direct and reliable evidence that it is so, for the recoveries may have been due to other causes. Mr. Cheatle's is a most interesting case, but it does not prove his fourth conclusion, rather, indeed, the opposite, as has already been suggested.

W. F. Stevenson,
Surgeon-General, A.M.S.

THE ANKYLOSTOMUM, THE STRONGYLUS, THE TRICOCEPHALUS, THE ASCARIS, AND AN ASSOCIATED INFUSORIAN IN WEST AFRICA—CHIEFLY IN REGARD TO MILITARY INEFFICIENCY; MODES OF INFECTION, AND LIFE HISTORY OF THE PARASITES; ALSO A NOTE ON AN UNIDENTIFIED WORM.[1]

By Major F. SMITH, D.S.O., R.A.M.C.

Part I.

Ankylostomiasis in Sierra Leone.

Ankylostomiasis has not been regarded generally as a Sierra Leone disease. The annual reports of the Army and Civil Medical Departments of the Colony are equally free from reference to the parasite. It is evident, however, that the malady is a pathological entity of some importance among both the civil and military populations of Sierra Leone.

It might be thought that inasmuch as the disease was known to exist in other parts of tropical Africa, we could take it for granted we should find it here. The fallacy of such a line of argument is clear from the fact that yellow fever, guinea-worm and sleeping sickness are not endemic in Sierra Leone.

Case 1.—Private ———. The first case met with this tour was in hospital under the heading of malarial fever, and is one of the negative results mentioned in a paper by Major Pearse and myself in the March (1904) number of the Journal. Repeated examination showed no blood parasites. Tubercle was then suspected, but the bacillus could not be found. Various possibilities in the way of diseases of the stomach and gall-bladder were duly discussed. Finally, I got a specimen of the stools, and at once found ova of ankylostoma. It was forthwith recognised that the symptoms were typical of the disease as set forth in the text-books. The man had been over three months in hospital with irregular intermittent fever, ranging between sub-normal and 102·4°. He was slightly dyspeptic and much weakened. His only subjective symptom of any constancy was a tenderness and pain just below the ensiform cartilage.

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[1] Part I. and some of Part II. of this paper was in print in May last; publication was withheld pending further investigation.

Having found a first case it was a matter of a few days only to pick out more,[1] *e.g.* :—

CASES 2 AND 3.—Privates ———. These men have also been mentioned in the afore-quoted paper, they being among the sickly-looking men who had been selected on parade to be examined for malarial organisms, and had given negative results. They afterwards came into hospital. The blood still showed no parasites. Spleno-puncture was carried out in Case 2, as he had low fever and splenic enlargement. In neither case, however, could other cause of illness than ankylostoma be demonstrated. Case 3 I had examined, with negative result, on a former occasion, the search for malaria having revealed pronounced eosinophilia.

It was soon seen that here, as elsewhere, it is not safe to take it for granted that the parasites are causing the illness of every patient in whom they may be discovered.

The Blood Count.—Pronounced eosinophilia led to recognition of the disease in some cases; but its absence does not exclude ankylostomiasis, for Case 1 showed less than half per cent. eosinophiles.[2]

CASE 4.—Private ———. This complex case gives some idea of the many factors which may interfere with the interpretation of the differential count.

Case diagnosed gonorrhœa. When first seen by me had been in hospital for a long time with suppuration of the glands of the groin. He was now getting severe fever of a somewhat malarial type, but unaffected by quinine. The spleen was much enlarged. Careful examination day and night for malaria and filaria revealed no organisms. Eventually the fæces were searched and ova of ankylostomes discovered. Treatment brought about little improvement in the patient's condition. Meantime, a cough developed, and there were physical signs of disease in one lung. The sputum contained only glairy mucus, in which there were no tubercle bacilli. A little later, however, pus appeared in the sputum, and the tubercle bacillus was demonstrated. Probably this man had malaria during some part of his illness. He gave a history of fever attacks. His qualitative leucocyte count was :—

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[1] I have to thank Capt. A. C. Fox, O.C. Station Hospital, Mount Aureol, for suggesting cases Nos. 3 and 4 as likely subjects, and for facilitating examination of other cases, all of which were in his hospital.

[2] A. E. Boycott (*Brit. Med. Journ.*, November 14, 1903), says that the leucocytic reaction wears off in chronic cases.

	January 16.	February 4.
Polynuclears	45	59
Eosinophiles	2½	8
Mononuclears	13½	15
Lymphocytes	39	18

What relation this man's maladies bore to each other is entirely a matter of speculation, the ankylostomes had no doubt a debilitating influence.

Another case was of the class known at one time as *post-malarial fever*, that is, he had suffered from malaria and remained in hospital owing to the persistence of a slight temperature. In this connection it is interesting to note the *post-malarial eosinophilia* mentioned by Cabot on the authority of Gravitz.

Method of Ascertaining Extent of Prevalence.

General examination of fæces was considered more or less impracticable, but some idea of the state of affairs was obtained by examining a few selected men, and by *taking specimens haphazard from the latrine buckets.*

Of three men in one company, picked out for me by Captain A. C. Fox, R.A.M.C., at the weekly inspection, two harboured the parasites.

Of three specimens from the latrine buckets, one gave a positive result. Of six specimens on another occasion the ova were found in one.

Three deposits of human excrement in the jungle near Kortright Barracks were examined, and one of them was full of ova. (These deposits were probably not all made by soldiers.)

So much for the troops: the results indicate extensive prevalence of the affection.

The Disease among the Civil Population.

By request of Dr. W. Renner, I examined a case of severe anæmia in a man of the carrier class in the Colonial Hospital. The blood examination showed marked eosinophilia but no parasites. The fæces were crowded with ova of ankylostomes.

A single deposit in the bush where some workmen were engaged at Mount Aureol showed infection. A mixture of three deposits from the same place contained ova. Of four specimens from another part of Mount Aureol two were infected, and again two out of three, and of two, both.

Anæmia and debility all the same do not seem to be more common here than in other places, less so probably than in England.

In all likelihood a certain amount of *toleration* to moderate infection is acquired by those born in an endemic area. Indeed, if the ordinary theories as to infection by embryo larvæ through skin and stomach be accepted, immunity must be admitted—for the subjects of the disease, except among the most scrupulously cleanly, would otherwise go from bad to worse owing to self-infection.

Part II.

Sources of Infection. Natural History of Parasite.

As far as the troops are concerned we have here none of the conditions usually held to be associated with the existence of ankylostomiasis. There are no gross insanitary conditions. The barracks in which the cases occurred are high and dry on the hills at Mount Aureol and Kortright. The floors of the huts are raised some feet from the cemented ground and have well-ventilated air space beneath. There is no muddy wet soil even during the rains, the steep hills affording no resting-place for water. All the men, however, had been living under canvas on the barrack square during part of the dry weather.

Of the two companies in which the cases were met with, one had been stationed at Kortright nine months ago and one is still there. There is a mountain brook, half a mile from Kortright, in which the men wash their clothes. The brook comes through the insanitary villages of Gloucester and Leicester, which are on its steep banks. The women wash clothing in the stream. The inhabitants are mainly engaged in market gardening. The gardens are along the edge of the stream for convenience in watering during the dry weather. There is a constant drain of manurial water into the stream, inasmuch as the gardens are copiously watered daily. The soldiers on their washing day strip and spend hours in the water. They also drink from the stream. Naturally, in view of the text-book accounts of the life history of the parasite, the polluted brook came under suspicion as a source of infection by the stomach, through the skin, or in both ways. It was also noted that fruit from the villages was sold in barracks.

Pollution of Drinking Water.

That we have a possible source of infection nearer home is evident from the fact that ankylostomal human fæces were found deposited in the bush in our water-collecting area, within a few

yards of the water, and within a hundred yards of the intake. Our water supply, however, is a hill-brook with rapid fall, and it may be supposed that any infection of it must take place during the rains when the surface pollutions are washed into the stream on a large scale.

Ankylostoma of Pigs and other Animals.

A word as to the animals which may pollute our water and surroundings.

Dogs we know harbour ankylostomes. Leicester swarms with dogs. It has also a large population of pigs roaming the grounds. As both pigs and dogs are eaters of human fæces we might expect them to breed the same ankylostomes as human beings.

I have found in the fæces of Leicester pigs ova and embryos which in appearance are identical with those of the human parasite.

There are probably other animals acting as hosts. A large toad from the water area had live embryos resembling those of the ankylostomum in the fæces, but I found no adult worms in any part of the gut.

To what extent ankylostomes are transferable from species to species is, so far, undetermined.

I have said that infection of the troops through drinking water would have to take place chiefly in wet weather, as regards our regular water supply. This raises the question as to whether the parasite can stand drying in fæces or earth. We are told by Manson that the embryo dies in Chinese dung-pits, and that "It is known that if the ova of the ankylostomum are kept in pure fæces the embryo is developed, and escapes from the egg in due course; it is also known that, unless the embryo be supplied with a certain amount of air and earth, it soon dies." Experiments given further on show earth to be unnecessary.

It has been stated by other observers that the embryos die off quickly in water, and that this fluid is, therefore, unlikely to be a means of infection. The circumstances, for all that, seem to point to water infection. The ova hatch out quickly in water; they swim about freely. The water is a handy and certain medium through which the parasite would reach its victims. As for all the myriads of parasites deposited in the bush, they may, if we accept text-book methods of infection (*see* Manson's "Tropical Diseases"), be almost disregarded if they do not get at us through water. They would be doomed to lie harmlessly till their death,

unless perhaps they were brought out in the stomach of an ordure-eating animal. We are told that the embryos die off in the water, then our thoughts naturally turn in the direction of the intermediate host.

Ankylostoma Research. Life of the Parasite. Experiments.

In the endeavour to throw light on the subject and to test the worth of the statement with regard to death of embryos in water, I placed a quantity of ankylostoma-infested human fæces in a tin and put the uncovered tin in the jungle. The dry season was on, but one shower occurred. The contents of the tin underwent the usual changes, became full of maggots, dried up and lost the fæcal odour. After the tin and contents had been exposed for two months the fæcal residue was covered with water. Some 40 hours later I examined for ankylostoma and found numbers of dead embryos. They stained well as though newly dead. That they were not merely torpid is evident from the fact that they disintegrated in the course of a few days.

Sun-dried human fæces picked up in the bush were soaked for 20 hours. Dead embryos and some adult eggs were found in the centrifuged fluid poured off.

In none of these cases were the embryos very plentiful. The fæces kept for two months was crammed with ova when in the fresh state, whereas after drying the embryos had to be hunted for.

Dog fæces on dry earth in a room were found, when soaked in water for a few minutes, to contain live larvæ in decreasing numbers up to the fifteenth day, the fæces had become dry and hard some days earlier.

We see then that there is ground for believing that the *viability of the parasite is retained under apparently adverse conditions.* It withstands drying. The application of water brings it into life. In this country of torrential rain this means that *life would mostly begin in the nearest watercourse* or pool. This bountiful provision of nature for the parasite's welfare cannot well be for nothing. There may be two ways of life, but the aquatic seems certain to be one of them. That it is not an essential way seems equally certain, judging by the following evidence concerning ankylostomes in the dog, for we may take it that the parasite of the dog behaves in much the same way as does that of man, though we are not quite sure that the organisms are identical and transferable.

Drinking Water definitely Excluded in some cases. Mature Parasites in Pups 8 *weeks old.*

A litter of pups was born in the Officers' Mess premises at Kortright in the very dry season. Eight weeks later I examined the fæces of two and found them infected with ankylostomes' ova. These little dogs had no mud to roll in. Their environment was absolutely dry. They were born on straw over the cement basement of the building. Most of their daytime existence was spent on the boarded floor of the Mess verandah. They did not leave their mother till they were six weeks old. It may be said then that they had practically only milk to drink up to the time of weaning. Such water as they got in the subsequent two weeks was from our own drinking supply, and that may be taken to be safe enough during the "dries." The amount they consumed is infinitesimal compared with what we ourselves drank. How were these pups infected? Before trying to answer let me say that I found parasites in still younger animals.

Sexually Mature Parasites in Pups aged 3 *weeks and* 4 *days.*

Three pups, stated to be aged 3 weeks and 4 days, were brought from one litter. The owner was a coloured man in Freetown, but I believe his statement as to age. The animals had the hazy-blue eye, the inability to stand, eat or lap properly, and the general appearance of being aged as stated. They were examined on the day they were weaned. All three were discharging multitudes of ova in their fæces.

One was killed and forthwith searched. A hundred and eighty one ankylostomes of various sizes were counted in the small intestine, chiefly jejunum. Many of them were *in coitu* and discharging ova.

Finally, a still younger pup was found to be infected.

Young Parasites in a Pup 8 *days old.*

An eight-day-old pup was examined. This animal's eyes were not yet opened. It could not walk. Obviously its sole nutriment had been mother's milk. Four ankylostomes were found hanging on to the wall of the small intestine. The largest was nearly full-grown, and was three times the size of the smallest. Evidently the parasites had been ingested on different dates. The pup was dry and clean of skin.

It is absolutely certain this pup was not infected through drinking water.

(*To be continued.*)

PRELIMINARY NOTE ON THE CULTIVATION OF THE LEISHMAN BODY.

By Captain J. C. B. STATHAM.
Royal Army Medical Corps.

With a view to confirming Rogers' experiment of June last, when he stated that he had grown flagellated organisms from Leishman bodies, punctures were made, forty minutes after death, into the spleen and liver in a case of Dum-Dum fever; the blood and tissues so derived were placed, under aseptic precautions, in tubes containing a small quantity of 4 per cent. solution of sodium citrate.

Private R., the case from which this material was derived, had long been considered one of Dum-Dum fever. From a year after he went to India (1898) up till 1901, when in Allahabad and Calcutta, he suffered from attacks of what was described as "ague." It was in Bombay, however, in 1902, that he had the most fever. The first attack of definite remittent fever appears to have taken place in Bombay in 1902, the fever continuing till he was invalided home in February. From his admission to Netley in March, till the time of his death from pneumonia, on December 4th, 1904, he had fever continuously, with the exception of several apyretic periods, the longest a month. The fever was chiefly of an intermittent type, the temperature seldom rising above 102° F. The other symptoms have been emaciation, anæmia, great enlargement of the spleen and enlargement of the liver; the spleen, during nearly the whole of his stay at Netley, extended down into the pelvis and to the right of the umbilicus. No other of the known symptoms of Dum-Dum fever were present.

Repeated examinations of the blood made during life, show the red cells to have been reduced; they varied from two to two and a half millions per cubic millimetre; the white cells were greatly reduced, varying from 1,500 to 2,500 per cubic millimetre, thus showing an absolute as well as a relative leukopenia. The large mononuclears varied from 19 per cent. to 25 per cent. of the total number; this increase was at the expense of the polynuclears. Splenic puncture was not obtainable during life.

The patient contracted pneumonia towards the end of November, and died at 11.30 p.m. on the 4th of this month (December). Forty minutes later the punctures and inoculations above referred to were

made, and the citrated splenic and hepatic blood incubated at 20°C. Smears of the blood obtained from these punctures and stained by Leishman's method, showed the presence of numerous Leishman bodies, chiefly intracellular.

The *post-mortem* examination, besides indicating that the patient had died from a double pneumonia, showed the great size of the liver (106 ozs.) and the spleen (87 ozs.).

No macroscopic changes were found in any part of the gastro-intestinal tract, and there was no enlargement of the mesenteric glands. In smears taken at the time and in sections cut afterwards, the presence of the Leishman body has been demonstrated in the spleen, liver, lungs and, in small numbers, in the suprarenal bodies; this part of the examination is, however, not yet completed.

On the morning of December 6th, after thirty-six hours' incubation, three blood smears were taken from the cultures and stained by Leishman's method. In the slides so prepared a few cells containing the bodies were noticed, as well as some free forms.

Many of the free Leishman bodies had increased considerably in size, their protoplasm stained a blue colour and was much vacuolated, while the much enlarged macronucleus stained faintly and had a less definite outline; the micronucleus, however, persisted more or less unchanged.

A second examination, made on December 7th, showed that the bodies had further increased in size, 5-7 μ, some were somewhat oval in shape; there was, however, so much vacuolation and the macronucleus stained so faintly, that I had begun to think that these were degenerating forms.

On December 8th definite flagellated bodies, 10-20 μ in length, were seen, and on further examination parasites of many shapes and sizes, varying from the original Leishman body to a long trypanosoma-like form, were found. Many of these forms showed longitudinal fission, while several instances of parasites developing in the splenic cells were noticed. Hanging drop preparations of the cultures have shown the parasite to be motile.

From December 8th till the 14th repeated examinations have served to show that growth was proceeding in most of the cultures, the parasites seen being much the same as those found on the 8th, with the exception that some extremely small and slender forms approximating somewhat to spirillæ were noticed.

Subcultures have been made into fresh citrated blood, and in these, as well as in similar cultures made by Major Leishman, very definite growth has been obtained. The organism appears to grow

in greyish-white granular masses on the white corpuscular layer of the citrated blood. Examination of these growths has shown the presence of parasites similar to those found in the original tubes.

Pond-water and tap-water inoculated with the cultures have been incubated at 20° C. and repeatedly examined, but although a few parasites have been found within the first few days, there are no evidences of growth in this medium and no flagellated forms have been seen.

Further work on this subject, in conjunction with Major Leishman, is proceeding, and it is hoped that it may be possible to make a fuller communication at a later date.

I have to thank Messrs. Steel, Proctor and Wells, I.M.S., for their unwearying and valuable help throughout the work.

NOTES MADE DURING A TOUR OF SPECIAL SERVICE IN NORTH CHINA IN 1894-1895 (CHINA-JAPANESE WAR.)

By Colonel H. E. R. JAMES.
Royal Army Medical Corps.

The writer was accredited to the Chinese Government and attached to the Chinese Army in the field, to report upon the medical organisation of their army, and upon the nature of the wounds caused by the small-bore rifle bullet which was expected to be used by the Japanese. But in respect of both objects the mission was fruitless, inasmuch as the Chinese Army had no sort of medical provision, and the Japanese, owing to some defect in their new small-bore magazine rifle, had recalled all those issued, and re-issued the former old Mourata rifle to their troops, whose calibre was ·432 of an inch, and which fired a toughened bullet much like that of the Martini-Henry rifle.

In view, however, of the locality of the fighting now proceeding in Manchuria and the climatic conditions of North China and Manchuria, and of the fact that the conditions of unpreparedness, military and medical, of the Chinese army are now much as described here, these notes may be found of some interest.

The war, at the time of our reaching Tientsin (November, 1894), had reached the following stage.

The Japanese had ejected the Chinese troops from Corea, where the battles of A-san, and Ping-yang had been fought, and the Army of Manchuria had taken Feng-hwang-cheng, and was marching on the Mo-tien-ling pass, which was said to be held by the Chinese. The Port Arthur army was being got ready, but had not embarked. The army which operated against Wei-hai-wei was a third and distinct army which was subsequently formed.

The only railway then existing was between Tong-kou (near the mouth of the Pei-ho) and Tientsin, and Tientsin and Shan-hai-kwan at the termination of the great wall of China on the Pechili gulf. All other journeys had to be made by road or boat.

Communication by water ceases about the middle of November, when the country is frozen hard, and so remains till March.

The Chinese Soldier.

Personnel.—The great majority of Chinese troops in the neighbourhood of Shan-hai-kwan, Peking, and Tientsin were Northern

men. Their physique is better, and they are larger men than the Southern and Western Chinese. They are recruited, however, from the lowest class, and their life is an idle one in peace-time. They practice all the vices. They have been drilled generally in the German fashion, but they are indifferently set up and never look smart. (I am not now speaking of the Manchus). Their winter dress consists of a camlet *coat*, *trousers* and divided *apron*, a *cummerbund*, linen or cotton *socks* with quilted soles, cloth, velvet, or thin leather *boots* with thick paper soles covered with string. *Underclothing*, generally of cotton and according to the wearer's fancy. A sheepskin *great-coat*, reaching to the ankles. The sheepskin coat is not worn by all, as I believe the Commander of the regiment receives money for dressing his men, and does not always supply this article. The trousers are gathered in about the ankles with the socks inside, and a webbing bandage is wrapped circularly round the junction.

The *infantry* are variously armed, or unarmed, as the case may be. A regiment on the march is ordered as follows: They march in single file generally, and the number of the main body may be about 200. In front come two trumpeters with straight brass trumpets like coach horns. Following them are from twenty to forty standard bearers. These are succeeded by ten to twenty men with halberts and tridents, and these by one or two jingals, each carried by two men. The remainder carry firearms of various patterns—old tower muskets, Enfield rifles, Remingtons, Martini-Henry, and Mauser-Mannlicher magazine rifles, all very dirty and with the bayonets fixed; sometimes the scabbard is on the bayonet, with the belt and pouch attached. None of the men I saw had valises, but they seem to be at liberty to carry any article they can. All have tobacco or opium pipes, some umbrellas or swords tied upon their backs. After the rank and file follows a clerk on horseback with the commission of the Commander and other officers stuck into a pouch on his back, and visible above his head and shoulders. The Commander follows in a sedan chair or cart, surrounded by a small cavalry escort.

The regimental baggage follows at large intervals in drays; the baggage guard and a number of stragglers riding in the carts. Stragglers may be seen singly or in groups of three or four at any point from the last halting place, and may amount to 100 or 200 men.

The marches are generally arranged to suit the ordinary pedestrian rest-houses, which are about twelve miles apart, and the men go much as they please; and I have seen a man fall out to try and

shoot a pigeon with his rifle. The Company officers carry swords but are otherwise not distinguishable from the men. This description applies to the majority of the regiments that I saw, but there are better armed men than these among the Viceroy Li's special troops. At Pa-li-chao bridge I saw a whole Khansu regiment without any fire-arms at all.

The arms are sometimes tied together in bundles and carried in the baggage waggons, together with cooking utensils and bows and arrows.

The *cavalry* do not march in very large bodies; the largest body I saw numbered seventy-eight men. These were in three squadrons. They ride Mongolian ponies, and are armed with a long lance (about twelve feet) with a wooden shaft and iron head, and carry a heavy sword, which is fastened to the saddle under the left thigh, and a carbine (pattern various). They also have a profusion of banners. They ride with a very short stirrup but seem fair horsemen.

The *artillery* are said to be better drilled than the other arms.

The dress of the Southern troops differs from that of the Northern, in that they wear a black or dark green turban, instead of a felt cap, in winter. They are smaller men, but are not essentially different.

The *camps* are generally permanent, or if new, are placed in the neighbourhood of permanent camps. The older camps have walls 10 to 30 feet high, made of mud and chopped straw (there is no stone in this country). They are rectangular in plan, and the walls are triangularly prismatic in section and sometimes crenulated at the top. A gun is placed at each angle. Each camp generally contains 400 to 600 men, who are housed, in the permanent camps, in mud huts. The Commanding officer has a yamên often of large dimensions.

The sites of camps are generally chosen with reference to water-supply or other convenience, and their strategic position is of secondary importance. New camps have walls of 5 or 6 feet high, which are added to according to the length of time of their occupation. The first thing a regiment does on choosing a camping ground, is to make a mud wall, inside which everything is placed at once.

In newly constructed camps and temporary posts, tents are used. They are of the pâl pattern made of two thicknesses of cotton, blue or white, and have an area of about 100 square feet. As many men as can lie in this space are crowded into them.

Their arms are piled outside. There are no special means of ablution, and there is very little desire for ablution on the part of the men in winter. They go outside the camp to defæcate, and the fæces are either collected by the peasants for manure, or eaten by pigs and dogs. There is surprisingly little filth about these camps. The camps are almost always near a river or near an old well. Very little water is drunk as such, as tea is the universal beverage. All the water in the Chili plain is saturated with salts, and all the stream waters have a great quantity of sediment. The water is cleared with alum before it is used by means of a crystal of alum set in a cleft bamboo which is stirred about in the vessel.

The Northern troops use Kao-liang (giant millet) as their staple food; pork and mutton and fish when procurable. Fish abounds everywhere in this country and is generally wholesome. The Southern troops and Manchu "Bannermen" use rice, which is imported from the South.

All Chinamen cook their own food, and in the regiments the men are divided into squads for messing purposes.

Supply of fuel is the great difficulty in this country, as coal is not used by the peasants, and there are no trees available. Charcoal and dead grass and Kao-liang straw are used as fuel, both for cooking and for warmth, and great economy is exercised in their use. Every child has a bamboo rake to collect fragments, and every combustible substance is continually gathered. The charcoal comes in great measure from Manchuria.

The cooking is done over clay braziers, and most of the food is boiled. The rice and Kao-liang are boiled in thin cast-iron vessels of about three gallon capacity. The men during the war were engaged at seven taels (about £1) a month, but they never received more than three, and it happened more than once that they received no pay at all for two months.

Desertion was very frequent, and whole groups of men who had enlisted from the railway and arsenal would return to their work in two or three days after enlisting, the richer by a suit of camlet uniform. The men are paid in brass cash, which is very bulky and difficult of conveyance. Fifteen railway trucks were employed to carry the pay of 7,000 men for two months in this coin.

Transport.—The transport of stores and passenger traffic, excluding the railway traffic from Tientsin *viâ* Taku, and the steamboat traffic up the Peiho to Tientsin, is effected by rail or by water. The road conveyances in common use are heavy carts or drays, light passenger carts, wheelbarrows, and rickshas. Not much

carrying is done by hand in this part of the country. Camels ply as far as Ho-shi-wu, carrying coal, wool, &c., and mules, ponies and donkeys are used for riding. Mule litters are occasionally seen, and persons of distinction travel in sedan chairs with four to eight bearers.

The roads are in the best condition during the winter, and for considerable distances from Peking, and also on the road from Tientsin to Peking; they were in former times well constructed and flagged, but have now fallen into disrepair, partly, no doubt, owing to floods, which have destroyed whole sections of the road. The whole of the country about Tientsin and Taku, and nearly up to Peking, is alluvial, and formed of an argillaceous detritus. In winter it is very compact, and where the road has disappeared carts easily travel over the fields. In summer, however, and during the rains, travelling by land is difficult.

The *drays*, or heavy carts, are generally used for goods traffic. They are two-wheeled conveyances, and can carry about three tons. They are drawn by three or more animals abreast, and travel about two and a half to three miles an hour. They are without springs, and make frequent stoppages. The gauge for all wheeled conveyances has to be the same, as they travel in one another's tracks, and the ruts are often a foot in depth. Forty-four inches is the width of these carts between the inner edges of the tyres. They could carry *two* wounded men *lying down*, and *four* or *five sitting*, in addition to the driver. Plenty of straw would have to be put into the cart to give spring, as otherwise the jolting would be intolerable. The slow pace is also a drawback.

Light Carts.—These carts are generally used for passengers, and the cart system in use in North China is said by those capable of judging, to be the best possible in this country. They are strong, their construction is simple, they are easily repaired, and they are so much on one pattern that their parts are almost interchangeable. I append a drawing to scale of one of those used within the Great Wall. Beyond the Great Wall the gauge is wider, and to meet this the wheels of those carts which travel both inside and outside, can be shifted to suit either gauge, the axle tree being adapted to this end. These carts carry about half a ton, and can go up to seven miles an hour, their average pace being a little over five miles. They have no springs, indeed, no vehicle with springs would be able to survive the unevennesses of the roads for any length of time. They are drawn by one mule or pony, or by two, tandem. The passenger sits inside, and the driver on the spring of the shaft. The baggage

is put on the cart's tail. They have hoops and a hood which can be extended by means of a spar socketed into the shaft, so as to cover the driver, and the mule as far as its withers. A certain amount of spring in the grandee's carts is given, by putting the axle tree quite at the tail end of the cart. This is not generally done, as it throws too much weight on the wheeler's back.

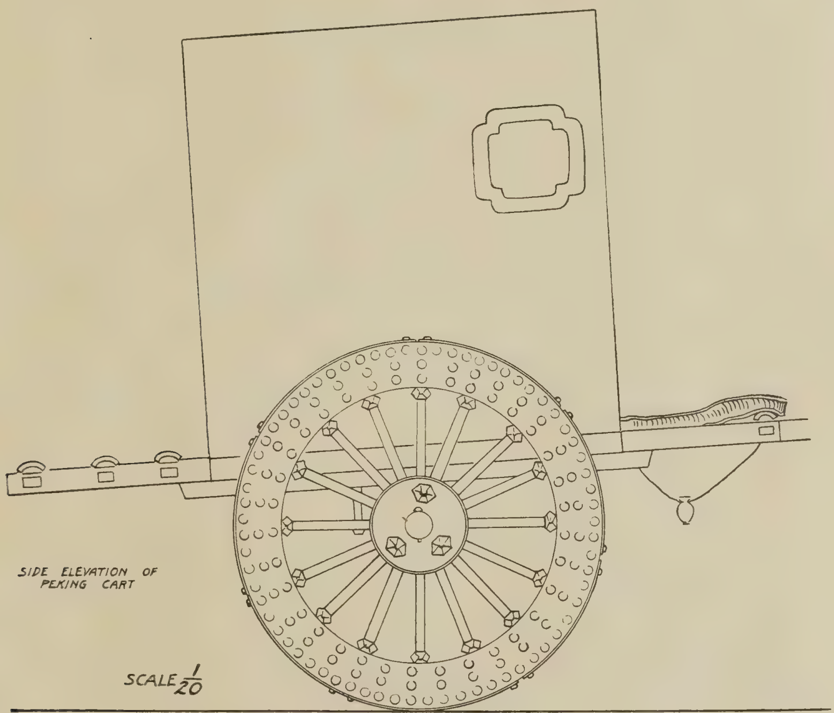

FIG. 1.

The axle tree, which is as costly as the whole of the rest of the cart, is made of hard wood from Szechuen, of a particular kind. Into the axle where the inner and outer ends of the nave come, are let four steel pegs of 2 by $\frac{1}{2}$ by $\frac{1}{2}$ inch, the ends of which bear against the inner surface of brass castings. These castings are let into the nave of the wheel.

When the pegs are worn down, or the brasses are worn large, the pegs are withdrawn and padded up with paper. They are then replaced, and a firm bearing is obtained (see sketch).

The shafts are continuous with the cart tail, and are fastened to the frame, which is slotted to receive wooden pegs of about ten inches in length. These latter hold the axle tree in place.

The body of the cart is a light superstructure, with panels behind and at the sides. The hood is upon a bamboo frame and attached to the panels.

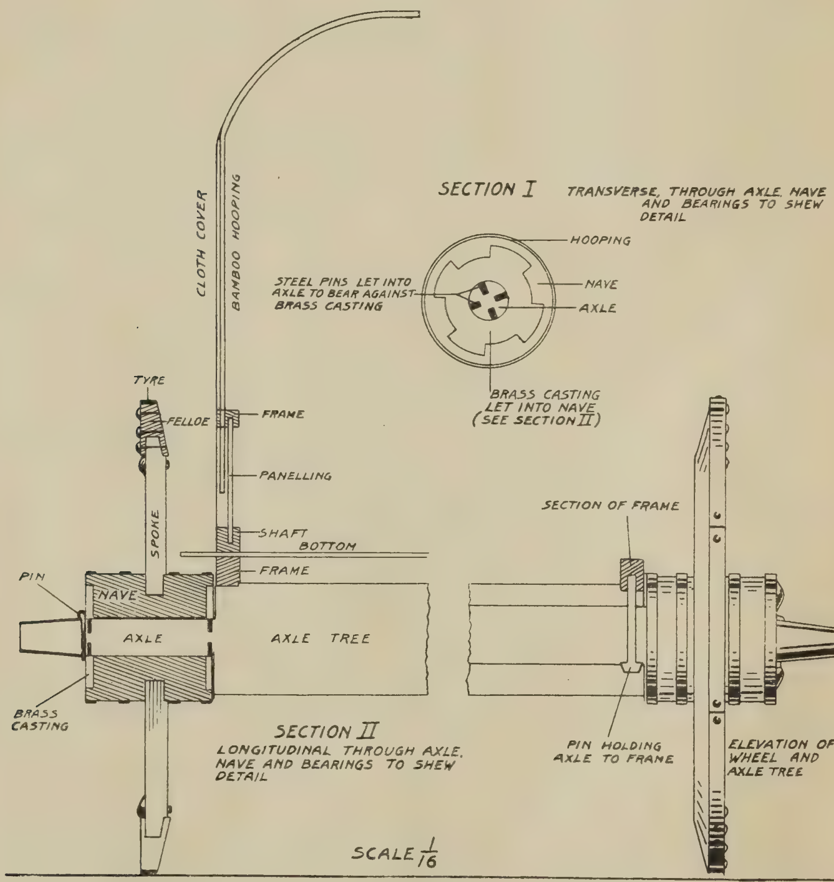

Fig. 2.

When the hinder panels are removed, a longitudinal space of seven feet is obtained.

One wounded man lying down, one man sitting, and the driver, could be accommodated in such a cart.

Plenty of straw, or an old pattern waggon-stretcher would be necessary.

Wheelbarrows.—The wheelbarrows used here could not very well carry a lying down wounded man, but could easily carry two men sitting. They can carry about three cwt., and are used a good deal by passengers for short distances. Very often a pony or donkey is used to draw them, as well as the man who pushes and guides.

Mule Litters.—These are practically sedan chairs, with a mule in front and one behind. Only sitting up accommodation is afforded for one person. Travel five miles an hour on good ground.

Sedan Chairs.—The accommodation is for one person only, sitting, but the carriers might very well be utilised as dhooly or stretcher-bearers. Travel four miles an hour.

Rickshas.—These can only be used on fair roads, and then for one person sitting.

Water Transport—The usual summer mode of travelling from Tientsin to Peking is by water as far as Tung Chow, and for sick and wounded it would be far preferable to any existing land conveyance. The Peiho is navigable by small steam launches up to Tung Chow, and one steam launch or cutter could tow four to six travelling boats up stream. The river is very tortuous, and requires experience in its navigation, but with this, the journey from Tientsin to Peking could be done in forty-eight hours. The usual means of working up are sailing and tracking, and only in very strong W. or N.W. winds is it necessary to tie up. The journey down with the stream is without difficulty.

The Grand Canal is another waterway, and the whole country is so intersected by canals, that given an action anywhere in the neighbourhood in other than winter months, water transport should be largely used for the conveyance of wounded. In the winter *peizas*, or ice-sledges, would take the place of boats in a very great measure.

Boats.—The ordinary passenger boats carry two passengers with separate sitting and sleeping accommodation, and, as a rule, three hands.

If necessary, four lying down and six sitting wounded men could be carried in one of these.

There are larger boats which could take eight men lying down and twelve sitting.

The number of boats is practically unlimited.

The *Medical Organisation* amounts to nothing. If catechised,

the Chinese Generals say that every camp, or regiment, called a "Ying," has its surgeon and its hospital, but the fact is that generally no such person as the surgeon, and no such place as the hospital, exist. The Viceroy, Li-Hung-Chang, of Chili, prompted

Fig. 3.—Peiza (ice-sledge used on frozen canals), propelled by iron-shod pole.

by Europeans long before the war, built a hospital at Tientsin and a medical school, and his wife endowed them. These were for the purpose of treating the sick, soldiers and others, and of instructing Chinese students in the Western science of medicine, with the view

ultimately of making them Army Surgeons. At the same time a teacher was procured from England, and Dr. Irwin, of Tientsin, was appointed Surgeon-General to the Chinese Army, and Superintendent-in-Chief of the Tientsin Hospital, with one Kin, a Western-taught Chinese doctor, to assist him. Medical stores were got from Home, and the establishment started. A hospital in connection with the Navy was made at Wei-hai-wei, and another at Port Arthur, where European surgeons were employed. Thus far all went well. But at the time when the war broke out, there were no surgeons ready to be sent to the Army, with the exception of Dr. Kin, who was detached from his post at the Tientsin Medical School, where he was assistant teacher. No medical Field stores were ready, and consequently the Army had no medical attendance to look forward to.

When the authorities were appealed to, *three thousand taels* (£525) were offered to provide medical equipment for the entire army. It was therefore manifestly not the intention of the Chinese Goverment to strain themselves in this direction. In the fleet the case was similar. During the operations in Korea, no medical attendance was forthcoming. The hospital at Port Arthur had to be abandoned, owing to the demeanour of the troops there on the threatened attack by the Japanese. At Wei-hai-wei the Chinese Hospital subordinates bolted, and left Dr. Kirke to do all the work. This hospital had also eventually to be left.

When General Sung occupied Mo-tien-ling, and the Japanese were advancing in Manchuria, Dr. Kin was ordered to proceed to the scene of action, and was provided with some trivial medical stores. He was to go to Niu-chwang, and from thence to proceed towards the front. He found great difficulty in obtaining transport, and his mission was not appreciated, nor were his movements assisted by the Chinese Generals. Eventually he got to Kinchow, in Manchuria, when the Japanese were at Hai-cheng, and there he treated, as best he could, a great number of wounded who had got so far, and temporarily dressed the wounds of many others who were on their way to Tientsin. He had one apothecary with him who assisted him, and these two had to treat the wounded of the entire Army of the North.

From Kinchow the wounded found their way to Niu-chwang, where they were treated by volunteer Missionary and Naval Surgeons. From Niu-chwang they passed to Shan-hai-kwan, where again for a short time there were two doctors of the Red Cross Society, who attended to them. At Shan-hai-kwan they were entrained in trucks, &c., to Tientsin.

During the earlier part of the war, before the rivers had closed, a few wounded from A-san and Ping-yang had come in small numbers by various routes to Tientsin, and at that time there was sufficient, and more than sufficient accommodation for them in the Viceroy's Hospital, and in the London Missionary Hospital.

The interior economy of the Viceroy's Hospital was exceedingly bad, and great difficulty was always experienced in obtaining necessary articles. The nursing was done by ignorant coolies, and practically everything was left in the hands of the surgeons. The hospital was, however, occasionally visited by Chinese officials.

A reward or bonus of ten taels was given to a severely wounded man on his discharge, three taels to a slightly wounded man, and a daily allowance of fifteen mace was given for each patient, for his subsistence in hospital. This money had to pass through the hands of a native clerk, and I think not more than half of it ever found its way into the patient's food. In Chinese matters this "squeezing" is always inevitable.

Upwards of 1,200 patients were treated in the hospitals from first to last, and many who were healed passed through them to receive their bonus.

Towards the end of the war the Viceroy's Hospital was always full; but from the bad sanitation of the place, and the patients having to remain in the clothes in which they came in, it was necessary to avoid any but the most imperative operations. Hence the policy of interfering surgically as little as possible was followed.

On our arrival at Peking the British Minister held out but slender hopes of our being able to accompany the Chinese Army, as they were retreating at every point of contact with the enemy, and the whereabouts of their head quarters was a matter of conjecture.

We visited the Tsung-li-yamen (Chinese Foreign Office), under the auspices of the British Minister, to obtain credentials to Chinese generals, and an escort, but permission to join the fighting force was absolutely refused us.

Having failed in our object we returned to Tientsin, as being the most central place for access to any point.

Here we visited the Viceroy Li-Hung-Chang, to see whether he could give us any aid; but even he seemed suspicious of our intentions, and said that all he could do would be to give us a permit to visit the forts and camps at Shan-hai-kwan, at the rail head, where a force was being collected to oppose the Japanese advance from Manchuria to Peking. With these we proceeded by rail to

Shan-hai-kwan. Here also it was evident that we were regarded with suspicion.

The Chief Commander was General Woo-ta-Cheung, and there were two other Generals. We had been told to show our permits to them, and they would give us facilities for inspecting the works. We sent round our cards and the permits in the morning, but one General pleaded sickness, another business, and so forth, and it appeared probable that they had been told not to let us see too much. In the afternoon, however, Woo-ta-Cheung sent word that he would receive us in his camp. We got a mounted escort of two body-guard men and rode thither. His camp was a permanent one, and he had a large retinue and a military band. He professed willingness to further our views, and in conversation displayed a most amazing ignorance. His subsequent proceedings, which are notorious, show clearly how ignorant he and men of his class are.

We met and dined with two other military officials, and from them we obtained a number of statements as to the numbers and condition of the men, and as to commissariat and medical arrangements, upon the truth of which, however, no reliance could be placed. Having exhausted our resources of information, we returned to Tientsin.

In the meantime wounded had been coming in in driblets from Port Arthur and Corea, crossing the Gulf of Pe-Chili in junks and landing on the Southern Coast, and going overland to Tientsin. I therefore remained there to see as much as possible of them, as the authorities held out no hopes of our going to Manchuria, the Niu-chwang river would be closed very shortly, and the overland road was beset by fugitive soldiers, who were robbing and murdering freely. Great distress had fallen upon the inhabitants of the country on account of the excesses of the soldiers who were fleeing, and of those on their march towards the scene of operations. Mo-tien-ling Pass was supposed to be held by General Tsung, but the Japanese were moving slowly, and the information of the Chinese was so bad, that nothing could be received with confidence as to the state of things.

The water-communication was soon entirely suspended, owing to the freezing of the Pei-ho, and all the wounded arriving were frost-bitten to a greater or less extent, having had to journey long distances overland by any conveyance they could obtain. Many died on the way, and the state of the wounds of those who arrived was very filthy.

After the fall of Wei-hai-wei, a few wounded came from that place,

but it was not until February that they arrived in large numbers from the Manchurian battle-fields. During this month and March about 700 came by rail from Shan-hai-kwan, and were treated in the Viceroy's and the three missionary hospitals. I took charge of half of the Viceroy's Hospital at the expressed desire of Dr. Irwin, who was appointed to the charge of all medical affairs in the Chinese Army, and who was superintendent of that hospital. By this means I was enabled to see and treat with a free hand about 100 wounded for a period of six weeks, and to visit at the same time those in the other hospitals.

Japanese Arms.—As has been above stated the rifle used by the Land Force was the single loading Mourata rifle, invented by a Japanese officer, and manufactured in Japan. The barrel has five shallow grooves. The bullet is hardened, cylindrical, with rounded head and slightly hollowed base, has two cannelures, and is $1\frac{3}{16}$ inch long. Its weight is put down as 420 grains, and the powder charge 83 grains, but no doubt there are slight variations, as four bullets which I have weighed are all upwards of the weight stated. The old Mourata rifle has a sword bayonet. The Navy are armed with Sniders. I saw no case of Snider-bullet wound, which is quite unmistakable.

The officers and many of the camp followers carried Japanese swords, and I believe that all who could of the soldiers carried these swords in preference to the regulation weapon of the European model.

The shrapnel fire of the Japanese is said to have been very destructive and very alarming to the Chinese. The Japanese had mountain guns in three sections which were screwed together, as well as field guns. They had also rifle calibre machine guns. They are said to have been somewhat disappointed with the performances of the old Mourata rifle.

Wounds seen at Tientsin.—The wounds seen at Tientsin had been inflicted from twenty-two days (the shortest period) to six months, before the wounded arrived at the Tientsin hospitals. The patients had been able to leave the field and to exist for this length of time, suffering often great hardships and privation. They had had to walk or to find their own transport. They had had no medical treatment on the field. Nevertheless, many wounds had quite healed before their arrival at Tientsin. As might be supposed, those seen were generally superficial, or if a bone had been struck, in the upper extremity. Some bullets passed in the near neighbourhood of vital structures, and in several cases the lung

was wounded. One class of case, however, was conspicuously absent, viz., perforating or penetrating wound of abdomen.

One thing is certain, that a very small proportion of the wounded ever got to Tientsin, and of those likely otherwise to recover, many died by the accidents of frost-bite, exposure and other circumstances. Many were detained in the hospitals at Niu-chwang, some few, no doubt, found their way to their homes. Those that arrived said that many had died on the way.

The wounds were generally made by the old Mourata bullet, which is described. The Japanese were not armed with the new magazine rifle, and only four cases of lodgment of a small-bore bullet were found. But the size of the hole made in the clothes and the size of the wound led me to put down certain wounds as caused by a small-bore bullet, although positive evidence, by the finding of the bullet, had been wanting (the Chinese were latterly, many of them, armed with a repeating small-bore rifle—the Mauser Mannlicher—and some of them may have been accidentally shot by their own side). The old Mourata bullet is toughened, and it makes, in certain parts of the body, a very small wound. In cases which I judged had been inflicted by the small-bore bullet, the wound was a very clean one, and generally healed rapidly. It was impossible to get accurately at the distance at which the patient was from the rifle which wounded him, but some who were very sure about it stated from fifty yards to half a mile. In the aspect of the wound there was very little modification by range. On the whole, the wound made by the ·432 old Mourata bore is a favourable one. The bullet alters but little in shape on striking a bone at lodging ranges, and where a bone has been fractured the splitting has been inconsiderable. In the muscles the track left is clean and heals readily. The bullet carries but little before it into the wound, and the hole in the camlet is often merely a split. In the wounds of chest seen, where the lung had been perforated, there was very little sign of mischief when the patients arrived at Tientsin.

It may be interesting and *apropos* to take the case of one man as representing that of many of the wounded who arrived at Tientsin. This man was wounded at Tapingshan, in Manchuria. He was struck in the arm and the humerus fractured. According to his statement he ran until he could not run any more. He lost a good deal of blood. He dressed his wound as best he could and walked to Kinchow, where his wound was looked to by Dr. Kin. He then got to Shan-hai-kwan, by walking and riding in various carts, and was forwarded by rail to Tientsin. He begged food as

he went, and suffered much from cold and hunger. He suffered a great deal of pain, and when he arrived at Tientsin by rail from Shan-hai-kwan the wound was suppurating and very offensive. He had had no splint, and there was much deformity and swelling. He had fallen in with others and they journeyed together for mutual protection and aid. He had travelled for two months with a fractured arm, a distance of about 250 miles on foot, or in a cart, not counting the railway journey, and only had his wound dressed once. There were many similar cases. During February two or three men came in who had been wounded at Ping-Yang in September! There was no organised means of transport for them, and every man had to shift for himself. The whole country near the scene of operations was in an unsettled state, and very many people, peasants and soldiers, died of famine. It may therefore be seen that to have survived so much hardship was a promising element in those cases that got as far as Tientsin.

Remarks.—The treatment of cases of gunshot wounds by European surgeons on their arrival in hospital consisted in rest and cleanliness, as far as possible. No doubtful interference was attempted. In some cases progress was retarded by climatic fever of a relapsing type, and in one or two a process set in very like hospital gangrene. These were promptly treated and took on a healthy action. Iodine water was most effective in their cure, after free scraping and removal of sloughs. Perchloride of mercury was the staple antiseptic used, and iodoform as an adjunct. There were very few suitable special splints, and when necessary they had to be made. One great drawback to the comfort and safety of the patients was the want of a change of clothing in hospital. They had to lie in the clothes in which they were wounded, which were saturated with foul discharge and crawling with vermin. There were no baths for washing the patients, and the bedding consisted of a grass mat on planks. The food was also insufficient and inappropriate to certain cases. It speaks well for the recuperative powers of the men that they did so well. Very many of the wounds of one month's standing were soundly healed when seen, even in some cases where one of the smaller bones had been fractured.

I think that among the Chinese conservative surgery should be the rule. They all have a very strong objection to amputation, on religious grounds, and in cases where they had been recommended but refused to submit to it, I saw the recovery of the limb take place where it had seemed quite improbable.

CRETE AS A STATION, WITH A MOSQUITO CAMPAIGN CONDUCTED THERE IN 1903.

By Major C. J. MACDONALD.
Royal Army Medical Corps.

The British Army, in performing its duties of garrisoning the various parts of a world-wide empire, often finds itself in strange places, but nowhere, I think, does it occupy so peculiar a position as in Kandia, Crete, where it is stationed outside the actual limits of the Empire, and is nevertheless not on active service.

To the ordinary man in the street at home Crete is, I am afraid, practically an unknown quantity, or, if not altogether unknown, is simply classed by him vaguely as "in foreign parts," much in the same way as the ancient Greek or Roman relegated all peoples not his own to the category of barbarians. What is more surprising, however, is that, even amongst those who are supposed to have a more intimate knowledge of it, their ideas on the subject refer rather to those far-off days when Zeus was king and Minos ruled the land, than to anything of a more recent date, and I am sure they would be more prepared to furnish a description of Theseus' classic campaign against the Minotaur than give even the merest outline of those events which led to the intervention of the Powers and the inauguration of the present *regime*.

For the information of such, I may mention that it was as a result of that intervention that the island passed practically from under the sway of the Turk and became at least autonomous, if not actually independent. The fruits of this change became very soon apparent, and are becoming daily more so. Where up to then was chronic disorder, with exacerbations attended by crimes of violence in every form, there is now complete peace and a re-establishment of social order equal to the most settled country in Europe; and as a result the prosperity of the people is growing apace, and there is every prospect that they will eventually reach a high standard, even though there may be little hope that they will ever regain the position they occupied almost before the dawn of history.

The island is, of course, still nominally under the suzerainty of the Sultan, but in this instance I think that very indefinite, if at times useful, prerogative is reduced to the minimum possible. It has its own High Commissioner—Prince George of Greece—and it

is to maintain his authority that the four protecting Powers—Great Britain, France, Russia and Italy—have quartered there a certain number of their troops.

The British troops have their camp at Kandia, which is situated about midway on the northern coast, while the remainder of the international forces are stationed at Canea, about seventy miles to the west near Suda Bay.

The town of Kandia—the Heracleion of Homeric days—has a population of about 21,000, and is situated on the sea-shore of a roughly semi-circular plain, which is bounded on the other sides by an almost continuous range of hills. These in some places attain a considerable height, from 7,000 to 9,000 feet, especially to the south-west and south-east, where they are snow-clad for about eight months of the year. The plain slopes quickly from the higher ground to the sea, and, as is only to be expected in a country subject to a very heavy rainfall, it is scarred, fissured and very irregular; while the rivers that traverse it partake to a large extent of the character of mountain torrents, running with a full, rapid current in winter and dwindling down in the summer to comparatively small sluggish streams with numerous semi-stagnant pools, and in some instances becoming mere rivulets which spread out and struggle along over the rough, uneven beds. Two of them, as they approach sea-level, have rather wide margins of low-lying marshy ground, viz., the Third River, about four miles to the west, and the Kolomodi River, about a similar distance to the east.

The town itself is of the purely oriental type, all the houses in the residential portion, both rich and poor, being surrounded by a high wall, which completely conceals them from public view. Within the last few years, however, since the change of Government, a few houses built on the western plain have begun to spring up, and their number will no doubt gradually increase as time goes on, seeing that the Greek element forms more than half of the population. Three or four of the streets are fairly broad, and laid down with concrete or with large square blocks of stone, after Venetian fashion; but the majority are little more than narrow winding lanes and alleys. Shops in the ordinary sense of the term can hardly be said to exist, with few exceptions, as the commercial life of the place has not yet apparently reached the stage when the shop becomes differentiated from the workshop, and as a result the streets in the commercial part are simply lined by a succession of semi-open booths, in which the workers in brass, leather, &c., ply their trades and surround themselves with the products of their

labours for sale. The effect is no doubt quaint and picturesque, but the impression obtained is that of an oriental bazaar, rather than of anything approaching what one is accustomed to in the West.

The town, generally speaking, is kept very clean superficially, and there is an absence of smells which compares very favourably with towns of its class in the East; but its sanitary arrangements would, I am afraid, not stand a too close inspection. They can hardly be spoken of as forming a system, as they simply consist in most cases of separate and isolated cesspits in connection with each house, and these are apparently not dealt with in any organised or regular manner, being, in fact, as a rule, left severely alone, until they obtrude themselves too offensively to allow of further neglect. This state of things reaches its climax in the western portion of the town, which is the poorest quarter, mainly inhabited by Turks, and which is unfortunately also the part that comes in direct contact with the British camp. In that part the houses are little more than flat-roofed clay cubicles, each of which, however, is provided with a small high-walled courtyard of a few square yards superficial area, where is invariably to be found a well and a latrine, as often as not in immediate juxtaposition. The latter is without exception nothing more than a cesspit of a most unpleasant character, which is apparently never cleaned out until it overflows and invades the remainder of the courtyard.

This low standard of sanitation shows a great falling off from the water-borne scheme established by the Venetians during their occupation of the place, of which many remnants are still to be seen, and is also far inferior to the excellent system of drains recently disclosed in the excavation of the Palace of Knossos close by, which dates back to some 1500 or 2000 B.C. The "primitiveness" of the present arrangements can therefore hardly be described as prehistoric, and must be looked upon rather as a degeneration than as a lack of development. Such an unsatisfactory condition must necessarily be a constant source of danger to the town itself, and also to the camp, on account of its immediate proximity, although there was no disease amongst the troops, or apparently amongst the population generally, during the period under review, which could be ascribed to this cause. The present municipal authorities, however, appear to be enlightened and progressive, and seem anxious to raise the town to a standard more in keeping with Western ideas; but it is only natural that there should be at present many calls on the public purse to rectify the effects of centuries

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of indifference, if not actual chaos, and they are therefore not able to make as much progress in any particular direction as might perhaps be desired. They show, however, such a spirit of energy and intelligence in these matters that I think it is only reasonable to hope that a great improvement will be effected within the next few years.

The resources of the town in the way of amusements are naturally limited, and there is, in fact, little to tempt one to visit it, after the first novelty has worn off. Socially, of course, it is a closed book as far as the garrison is concerned, and even amongst the inhabitants themselves there seems to be little mixed social intercourse. This, however, is only to be expected amongst a people a large proportion of whom are Mahomedans by religion, and all of whom have been born and bred for generations under Mahomedan rule and influence, with all that that entails in the exaggerated privacy of the family life and the complete seclusion of the female element. The garrison has therefore to fall back on its own resources in this respect, and these are unfortunately not extensive. Some tennis can be had, when the wind in summer is not too strong, or when the rain in winter permits; and cricket, football and hockey can be played on a piece of rough, more or less level, ground in the moat, but polo is out of the question. Even riding is somewhat at a discount, as there are practically no roads, and the pathways are so uneven as to be quite unsuitable for going at any pace, while it is impossible to go across country, as where it is not actually under vines it is very hard, rough and lumpy.

Luckily there is a certain amount of shooting to be had in the autumn and winter, viz., duck and snipe in the marshy ground already mentioned, and partridge and cock in the glens and gorges of the neighbouring hills. The former are a very variable quantity, in some years affording very good sport, while in others they are practically non-existent; and as regards the latter, it is necessary to be somewhat of an expert mountaineer and fairly indifferent to fatigue to enable one to obtain even a very limited bag.

Besides the above, I may mention the archæological resources of the island, which are not only extremely interesting in themselves, but also afford an object for making many agreeable excursions in various directions, where the scenery alone would be a sufficient recompense for the trouble taken, and where the variety and gradation of tints, especially in the evening, are at times so remarkable that one would have to be as colour-blind as a camera not to observe and appreciate. A number of people of every nationality

interested in these *disjecta membra* of a bygone day visit the island annually between February and July, some to superintend the various excavations which are being carried on in different places, such as Knossos, Phaistos, Gortinus, &c.; others simply those who are desirous of seeing a land so redolent of mythological lore and who wish to view for themselves the footsteps of civilisation in its passage from Egypt and Asia Minor to Greece and Europe generally.

The climate is on the whole fairly good, but it is by no means an equable one. It is hot and relaxing in summer, especially during the month of May, when the south dust-laden siroccos are frequent, but it is more bearable later, when the north-west winds begin to prevail. It begins to get cool in September, and October is generally a very good month. The rains, as a rule, begin in November and generally continue, with varying intensity, until the end of March. They are usually very heavy and are accompanied by high, very cold winds, which are at times very trying; but there are occasional intervals of fine weather, which are very bright and bracing. The most trying element in the climate is undoubtedly the tendency to rapid changes of temperature, which are liable to occur at all seasons and which it is almost impossible to foresee or guard against.

That the general health of the inhabitants is not, however, appreciably affected prejudicially by these somewhat unfavourable climatic conditions, nor by the unsatisfactory state of their immediate sanitary surroundings, which have been already alluded to, and which prevail quite as much in the small country villages as in the larger towns, the present physique of the people is, I think, a sufficient index. This is well above the average for a southern race, and is especially noticeable in the country districts and in the highland valleys in the interior, where the fact is no doubt accentuated by the picturesque and manly national costume. A certain amount of leprosy, no doubt, exists amongst them, and the presence of some of these maimed and disfigured beings at the entrance gates of the town begging is fortunately a strange sight for Western eyes. They are not allowed to reside in the town itself, and as they are generally very poor, they have to make their homes in the caves a little to the east of it. These caves at first sight may not strike one as being very agreeable places to live in, but in reality they compare very favourably with the houses in the poorer quarters of the town. They are, if anything, superior in cubic space, light and ventilation, and are, in addition, devoid of an encircling wall and a

noisome courtyard. All those affected with this disease are, however, soon to be collected from the various districts and removed to the island of Spina Longa, which is situated a little to the east of the main island, and which has been set apart by the Cretan Government for their segregation. An asylum is at present being built there, which it is expected will be ready for their reception in about six months. It will be provided with a resident physician and all the necessary arrangements for the suitable care and treatment of these cases. The total number affected is not relatively large, being only 350 for the whole island, of whom about one-third are resident in the Kandia district, so that the disease cannot be said to show any marked prevalence.

The only disease which really does prevail amongst the population to any large extent is malaria, and that apparently they have become so accustomed to as to accept it as part of their every-day life without troubling themselves as to what might be its cause, much less contemplating any possible scheme of prophylaxis.

In the early days of our occupation outbreaks of this affection amongst the British troops were, I believe, looked upon simply as a recurrence of disease contracted outside the island and not due in any way to local infection, and if any of the natives were seen to be affected, it was considered to be a spread of the infection from the former; that, in fact, the troops were the foci for dissemination. Subsequent experience and a more extended knowledge of the island has, however, shown the converse to be the case, and has proved that the various epidemics which have occurred were in all cases due to local infection and that the disease was prevalent in the island long before our advent. How far back it dates as a cause of disease or how long it has been endemic in the island it is, of course, impossible to say, as there are no records at present known to us to throw light on the subject, but there is no doubt it goes back for a considerable time. In fact, to my mind, it would not be surprising, now that we are becoming accustomed to the subversive tendencies of modern research, if some day some savant arose to demonstrate that the yearly tribute of youths and maidens rendered to the Minotaur meant nothing more than the annual death-rate from malaria, and that that fearsome creature was none other than the humble *Anopheles;* Theseus' chivalrous undertaking naturally resolving itself into a somewhat antedated mosquito campaign. This would, no doubt, be a somewhat new reading of an old myth, but it would nevertheless be quite in keeping with ancient modes of thought and expression, and besides, it would be only in accord-

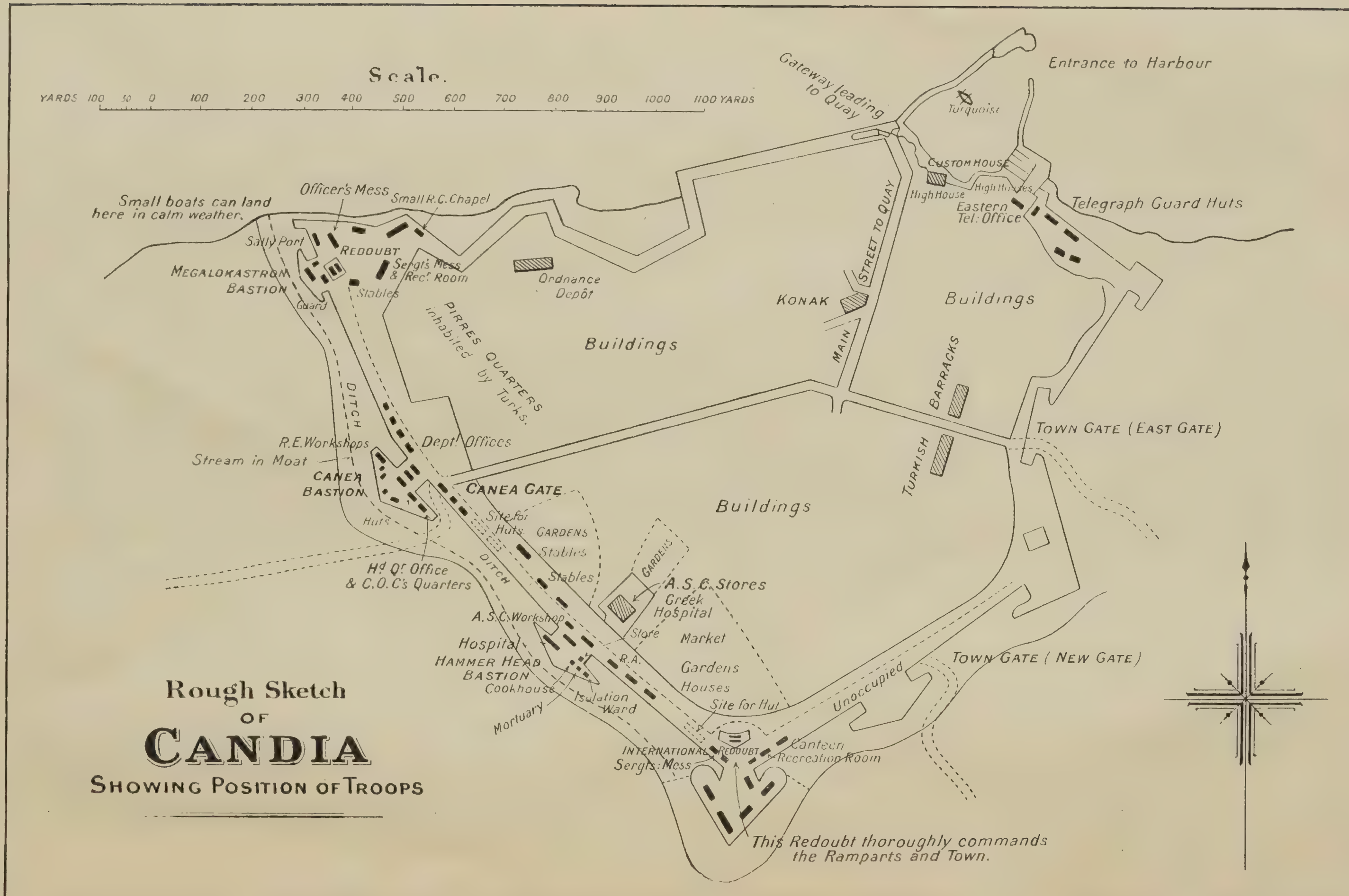
ance with the fitness of things, now that the far-famed labyrinth, which was supposed to have had such a definite place in the life of those days, has been shown by the light of recent excavations to have been nothing more than a double-headed axe, that our ideas with regard to the Minotaur himself should also suffer a similar disillusionment. But however that may be, the tribute taken by malaria, whether by death or loss of health, still continues, and, as far as this concerns the British troops, it is the main source of disease any medical officer stationed in Crete has to deal with and guard against.

Before enumerating the various steps taken by me during the year under review with this object, it may perhaps be advisable to give a short description of the Camp itself and its relations to the town, &c., so as to render it more easy to understand the measures adopted and to appreciate their relative values as a means of prophylaxis. As an aid in this matter I annex a sketch giving the more important details.

The camp is situated on the old Venetian ramparts on the western side of the town, extending from the sea-shore southwards and inland for about a mile. It is therefore necessarily very narrow compared with its length, but as the ramparts are higher than the ground on either side and have a good slope, it is dry, airy, and in itself satisfactory from a sanitary point of view. It is bounded on the outer or western side by a deep, broad moat, the southern part of which, near the International Redoubt, has a fertile soil, where rank grass and weeds grow freely if undisturbed, while the remainder consists of bare rock or soft clay, with little or no vegetation. Through the latter part there runs towards the sea a small stream, which is made up partly of drainage from the piece of ground higher up and partly from a spring rising a little below that part. My reason for describing this so fully will be apparent later. On the inner or eastern side the Camp is bounded in its southern half by some market gardens of various sizes, with the houses of the town beyond, while in its northern half the houses of the town come into direct contact with the camp limits.

The troops are accommodated in wooden huts, which are placed at intervals along the whole length of the camp. They are serviceable and satisfactory, although of course presenting the usual defects of such structures, being hotter in summer and colder in winter as compared with stone buildings.

I arrived in Crete on March 1st, 1903, accompanying the 1st Battalion Royal Dublin Fusiliers, and as past experience had shown



Rough Sketch
OF
CANDIA
SHOWING POSITION OF TROOPS

malaria to be the one prevailing disease amongst the troops there, a vigorous mosquito campaign was prosecuted throughout the year. Recognising, however, that it would be impossible to effect anything on a large scale in an island where malaria is prevalent everywhere, and in some places, such as the Plain of Messara to the south, in so epidemic a form as to compel even the natives to avoid it at certain seasons of the year, it was determined to concentrate all efforts within the danger zone, and then to prevent the men as far as possible from going outside that area at night-time. With the latter object night attacks, which necessitated the men remaining for hours in low-lying places amidst long grass in the vicinity of creeks and streams, and that, too, at a time when mosquitoes are most active, were discontinued at my recommendation, and a projected scheme of extended manœuvres, during which the men would have had to encamp in a country infested with mosquitoes, was similarly abandoned.

As soon as the rains began to ease off, all the ground in the camp and its vicinity was carefully examined for the purpose of localising as far as possible the various breeding grounds. Within the actual precincts of the camp itself there existed a large deep hollow in the ramparts in the vicinity of the International Redoubt, and quite close to some of the barrack rooms, in which rain-water collected in large quantities. As it had no means of exit it had to remain there until it passed off by evaporation, a process which would naturally take a considerable time. A permanent outlet was established so as to carry off the water as it fell, and a couple of disused wells close by were also permanently sealed up.

Outside the precincts of the camp, but within the danger zone, the following were the principal breeding grounds localised, together with the means adopted to deal with them :—

(1) *The Moat Outside the Ramparts.*—This, in my experience, was the most fertile breeding ground of *Anopheles*, and also the most likely to prove dangerous to the health of the troops, inasmuch as the men's barracks and rooms were the nearest habitations, being not more than a dozen yards away in some instances, while sources of infection were always present there during the day and evening in the numerous native boys playing or looking after goats and cattle. For convenience of description it may be divided into two parts :—

(*a*) That portion near the International Redoubt, which has a fertile soil, and which is about three acres in extent. This is indicated by a dotted line on the attached map. No large collection of water was ever apparent on the surface of this part, but the soil

was so completely water-logged, owing to the constant oozing from under the wall on the outer sides of the moat, that all tracks of cattle passing over it when grazing became so many small pools, in each of which were found innumerable larvæ, mostly *Anopheles.* To obviate this the long grass and weeds which covered it were cut away, and a system of drains established to carry off the excess water to the stream below. This proved thoroughly and permanently efficient.

(*b*) The stream already mentioned. At that time this meandered slowly down over an irregular bed towards the sea for a distance of about three-quarters of a mile. In some places it spread out, forming pools and back-eddies, and in others the banks were so soft in the immediate vicinity of the current that the goats and sheep which were constantly moving about this part caused numerous little collections of water, in all of which larvæ, mostly *Anopheles,* developed in large numbers. As a remedy the stream was trained and its banks stiffened with a layer of broken stones where required. This proved efficient.

In the part of the moat dealt with in the above two sections there also exists a number of mines of Venetian origin, dating back to the time of the Turkish siege, which extend outwards in various directions and to unknown distances under the glacis or outer boundary. In some of these accumulations of water were found, but I was unable to discover whether they contained larvæ or not, as it would prove a difficult, if not dangerous, undertaking. As, however, they appeared to be very possible breeding grounds, and, moreover, as all the innumerable long winding passages seemed to be very suitable places for mosquitoes to hibernate in, and were, in fact, found to contain them in large numbers whenever visited, I had all the apertures built up as a precautionary measure. The openings of several sally ports and underground passages in the ramparts were also similarly dealt with, with a like object.

(2) *The Wells and Tanks of various sizes used for Irrigation Purposes in the Market Gardens lying between the Southern Part of the Camp and the Town.*—These were also extensive breeding grounds, but mostly of the type *Culex.* They were kept perfectly under control, the wells by oil, and the tanks by having them run dry and then well swept out once a week. This was carried out by my own men by arrangement with the several owners.

(3) *The Wells in Connection with the Houses of the Town Bordering on the Camp.*—These were more difficult to keep under control, but they were also, in my opinion, less dangerous to the health of the

troops, not only because they were not so prolific comparatively, but also because it is doubtful that mosquitoes would travel some hundred yards for their food, when they had plenty in that way within a yard or two in the inhabitants of the adjoining houses. *Anopheles* were found to predominate in those which were seldom or little used, but were comparatively rare in those in constant use. Whether this was due to the females of this type instinctively choosing still water to lay their eggs in, or that much movement interfered with their development, it is impossible to say.

All these breeding grounds were constantly visited at regular intervals, and those which were not used for drinking purposes were treated with petroleum, and in those which were so used arrangements were made to have them kept covered as completely and continuously as possible. It was not thought advisable to have recourse to a volatile oil such as eucalyptus in dealing with the latter, as I was anxious to avoid even the appearance of tampering with the drinking water, lest it should create prejudice or be a source of unpleasantness.

This constant visiting, however, entailed much labour, and in the end was not altogether satisfactory. I therefore had an interview with the Governor, and recommended that water be laid on in pipes to this quarter, as to other parts of the town, and that fountains or standing taps be erected in several convenient situations, the wells in connection with each house to be subsequently closed or completely filled in. This he promised to take in hand at once, and to have completed before the following hot weather. The danger from this source will then be completely eliminated without further trouble.

(4) *Some Small Tanks in Connection with those Houses in which Wine is made.*—They are used for receiving the juice from the larger receptacles in which the grapes are pressed, and as they have no outlet, and are very deep compared with their superficial area, they might easily retain water throughout the summer. These were found to be very prolific breeding grounds of both *Anopheles* and *Culex,* and even in winter were more so than the wells above mentioned, as they are situated in very sheltered places and have very good exposure to the sun. They were kept under control by having them emptied at least once a week while the rains lasted.

(5) *The First River, which is about a Mile to the West of the Camp.*—This has been mentioned as a breeding ground in previous years, but it was not so in my experience. It occasionally becomes very sluggish during the summer months owing in a great measure

to the partial closing of its mouth by a sand-bank caused by the action of the sea. Periodic removal of this bank, however, rectified this.

(6) *A few Collections of Rain-water on the Irregular Ground to the South and West of the Camp, and a few scattered and little used Wells in the same Neighbourhood.*—The former only exist for a variable time after rain, and were as a rule drained off without difficulty, while the latter were treated with oil with success.

From the above it will be seen that the object aimed at in dealing with all these various breeding grounds has been not to rest satisfied with measures of a temporary character, such as the destruction of successive broods of larvæ as they developed, but rather to attack the grounds themselves and thus render them unsuitable for such purposes. Where this was not possible petroleum proved very efficient. This was especially the case in deep wells, which were seldom or little used, but even in those which were in constant use, if the oil was applied in sufficient quantity, it remained for a considerable time, apparently slipping off the full bucket as it emerged from the water, and then closing up and forming a continuous layer again at once. In these cases it not only destroyed the larvæ in the water at the time, but also apparently prevented other eggs being laid there, so long as it remained in any appreciable quantity. The above represent the the offensive means employed.

The defensive measures consisted of the following :—

(1) *Removal of all long grass and weeds* which could afford cover or a resting place for mosquitoes within the precincts of the Camp itself and in its immediate vicinity.

(2) *Immediate removal to Hospital of all men the moment they showed any signs of an approaching attack.*—This was issued as a Regimental Order, and posted up in each barrack room, the N.C.O.'s in charge being held responsible that it was strictly carried out.

(3) *Mosquito Nets.*—These were not used except in the hospital. The previous regiment left some behind, but as they were little bigger than a coverlet I condemned them as useless for the purpose required. At the same time, however, I submitted a recommendation that each man should be provided with a full-sized net, recognising that some such protection was necessary to guard against not only those mosquitoes that should escape destruction, but also against any that might wander in from outside the area operated on. No action was, however, taken in the matter, and the men were therefore without any protection of any kind in this respect throughout the fever season. If they had been protected, it is, I think, only

reasonable to suppose that it would have led to a still further reduction in the admission rate for malaria.

(4) *Quinine.*—In the month of July, as the men had no protecting nets, and a certain number of fever cases began to present themthemselves, this drug was issued to all troops at the rate of ten grains daily to each man, with subsequent reduction to five grains. It was not given as a means of prophylaxis against infection, but rather with the object of attacking the parasite in that undetermined number of men who had already become infected, but in whom the disease had not so far manifested itself, and in that respect it might, perhaps, be looked upon rather as an offensive than a defensive measure. In such cases it would, perhaps, modify or ward off the threatened attack, but what was more important, from my point of view, it would help to remove the parasite from the blood, and thus prevent any mosquitoes there might be from becoming infected. If the number of men so affected could have been determined the issue might, perhaps, have been restricted to such men, but in the absence of this knowledge it was decided to issue it indiscriminately. Such an effort to prevent any mosquitoes that should happen to survive from becoming infected, and thus becoming a centre for the spread of the disease and a source of danger to the other men, is, in my opinion, a necessary supplementary measure in any mosquito campaign.

The following are the species of mosquitoes which have been found on the island: *Anopheles maculipennis*, *Anopheles superpictus*, *Anopheles bifurcatus*, *Stegomyia fasciata*, *Culex spathipalpis*, *Culex fatigans*, *Culex pipiens*.

I will now turn to the statistics of this disease for the year, so that an estimate can be formed of the results attained. The general health of the troops was very good throughout, especially after the arrival of the 1st Royal Dublin Fusiliers, amongst whom there was hardly a single case of disease of importance due to local causes, with the exception of malaria. The epidemic due to this cause was, however, very mild, and as compared with the previous two years almost insignificant.

In 1901 a strength of 564 men gave 1,540 admissions (taking simple continued fever and malaria together), or an admission rate of 273 per cent.

In 1902 a strength of 460 men gave 1,084 admissions, or a rate of about 236 per cent.

In 1903 a strength of 410 men gave only 227 admissions (again taking the simple continued fever, of which there were five cases,

and the malaria together for the sake of comparison), or a rate of only 55 per cent. And even this marked disparity in the admission rate would be enhanced, if the admissions from the Cameron Highlanders for January and February, which were probably secondary attacks of disease contracted in the previous year, were taken away, and those from the Dublin Fusiliers substituted; that is, if, instead of taking the statistical year, the actual year of residence of the regiment in the island were taken. This would be a more accurate method of comparison, and taken in this way the admissions would only come to 183, or a rate of about 44 per cent. At no time during the year, not even in the months of July and August, when the admissions reached their highest point, did the epidemic assume serious proportions.

The disease was almost altogether of the tertian type and of a very mild form, as can be judged from the fact that, although no case was discharged from hospital until the temperature had been normal for ten days, the average duration of each case of sickness was only thirteen days. The range of temperature was almost invariably low, and the severe vomiting and general gastric disturbance usually observed in such cases were in the majority of the primary attacks conspicuous by their absence. The blood was examined in a number of cases and the parasite demonstrated. There were only eight cases of the remittent type, but even these were of a comparatively mild form, the fever never lasting for more than four days.

No deaths took place from it during the year, and no complications of any kind occurred, nor after-effects of a marked or persistent type, except in two cases, which were transferred to Malta for change in October—both with anæmia. In all the other cases recovery was rapid and complete.

Whether the mildness of both the above types and the absence of after-effects were in any way due to the quinine taken beforehand it is impossible to prove, but I think it most probable that it was in some measure due to this cause.

As regards the cause of the marked diminution in the admission rate above noted, it is, of course, difficult to speak absolutely definitely, as it is hard to eliminate all sources of error in coming to a conclusion. The Dublin Fusiliers were, I believe, of superior physique to the Cameron Highlanders, although I have had no opportunity of making any actual comparison, and the natural tendency therefore is to ascribe the difference in the admission rate to this fact alone; but I think it could hardly be supposed that they were also so much

superior in that respect to the North Lancashire Regiment, which was in Crete in 1901, to account for the even greater disparity which was apparent in their admission rate.

Superior physique, with the consequent increased resisting power, must, of course, count for something in such cases, but it has been my experience that that factor alone does not avail to any great extent in preventing the disease from manifesting itself in the presence of repeated infection, although it does, no doubt, help considerably to withstand the attack and to minimise the ill-effects likely to arise from it.

My opinion is that, making every allowance for this element, the cause of the diminution was in the main due to the mosquito campaign, which, as already stated, consisted not only in destroying as far as could be all possible vehicles of infection, but also in preventing those that might happen to survive such destruction from becoming infected, by the immediate segregation of all men the moment they showed signs of fever, and by attacking by means of quinine the parasite in those men who had suffered infection, but in whom the disease had not yet manifested itself.

THE IMPORTANCE OF LATRINE INFECTION IN THE SPREAD OF ENTERIC FEVER.

By Captain B. B. BURKE.
Royal Army Medical Corps.

The question as to how enteric fever is spread is one of great interest to the medical profession at large. To the members of the profession serving in the Royal Army Medical Corps it is perhaps more especially interesting, as to them it will assume vital importance during some period or other of their service, more particularly whilst abroad. Consequently, to be efficient, it is necessary for them to be familiar with this question in all its varied aspects. For this reason I venture to hope that the following account of an epidemic of enteric fever, starting from an imported case and spreading by latrine infection, may be of interest to the readers of our Journal.

During the months of November and December, 1903, and January, 1904, it was noticed that an unusual number of enteric fever cases were being admitted to the Station Hospital, Rawal Pindi, from the Wiltshire Regiment, then stationed in Church Lines. Being deputed by the Senior Medical Officer to enquire into this, I decided that a systematic enquiry into each individual case would probably lead one to the cause of the epidemic, and so enable stamping out measures to be taken.

On enquiry, I found that the Regiment had been free from enteric up to November 25th, 1903, when the first case (a man of a recently arrived draft) was admitted to hospital.

The sequence of cases from this date I have marked and numbered on the attached map of the lines according to the order in which they were admitted to hospital. Looking at the map it will be seen that the epidemic is practically localised to the Bungalows Nos. 2, 3, 5. The cases Nos. 1, 2, 3, which occurred in Bungalows 5, 3, 2 respectively, on November 25th, 26th and 27th, were the starting point of the epidemic. These cases were among men of a draft which had arrived in Rawal Pindi on November 17th, and it is more than probable that they contracted the disease on their way up country, during the fourteen days it took them to reach Rawal Pindi from Bombay.

This is borne out by the fact that the first six cases of the epidemic were all among men of this draft, occurring in the follow-

ing date-sequence, viz., November 25th, 26th, 27th, December 4th, 5th, 6th; while the first case among the men who were in Rawal Pindi prior to the arrival of the draft, did not occur until December 9th. After this date (December 9th), all the remaining cases that occurred with two exceptions (viz., one on December 20th and one on December 30th), were among men who had been in Pindi some time before the draft arrived.

Having got the starting point of the epidemic it now remained to find out how the disease was spreading from the draft to the older inhabitants. With this object in view, careful inquiries were made into all the likely channels by which the enteric could be spread, such as by milk, food, water, &c., with a negative result. The only other channels that remained were latrine or personal infection, and the fact that the latrines were responsible for the spread of the epidemic will, I venture to think, be amply borne out. Looking at the map of the Lines it will be seen that the Central Road divides the cases up into two groups of eight and nine cases respectively, which I will call A and B, and deal with separately.

In group A all the cases except one occurred in No. 5 Bungalow, the one exception being a draft man in No. 7 Bungalow admitted to hospital on December 30th. In this group the starting point of the disease was the case of November 25th (the first draft case). No more cases occurred until December 9th, when a previous resident was admitted, and the remaining cases, with the exception of No. 13, admitted on December 20th, were among the previous residents. Three out of the seven cases that occurred in this Bungalow were in one room (the rooms hold eighteen men each), but in no case were the beds in which the enteric cases slept near one another. Of the remaining four cases two were in one room and two in another, the beds in both instances being far apart. This seems to me to be against the idea of personal infection, although not quite putting it out of court.

Now of the latrine marked A one half is for the use of the men in this Bungalow, the remaining half being set apart for the use of No. 6 Bungalow. The latrine is of the usual Indian pattern, viz., twelve seats on each side with an open courtyard between. The men of No. 5 Bungalow were carefully questioned as to whether they always used their own side of the latrine, and they said that they invariably did so; the fact that no cases occurred in No. 6 Bungalow goes a long way to confirm this statement, as well as indicating the latrine (No. 5 Bungalow half) as being the probable seat of infection.

PART PLAN OF RAWAL PINDI CANTONMENT.

To take group B. In this group all the cases are confined to the Bungalows Nos. 2 and 3, with again a solitary exception, a draft man admitted on December 5th. In each of these Bungalows we have an imported case as the starting-point of the disease.

In No. 2 Bungalow, case No. 3, a draft man, admitted on November 27th, was the starting-point, and no more cases were admitted until December 16th and 30th, and in each instance it was a previous resident who contracted the disease, and each case occurred in a different room.

In No. 3 Bungalow, out of the five cases three were among men of the draft, viz. : Case No. 2, dated November 26th ; No. 4, dated December 4th ; and No. 6, dated December 6th. The remaining two cases were old residents, admitted on December 11th and 12th respectively. In this Bungalow only two cases occurred in the same room, viz., No. 2 case and No. 8 case, the latter being an old resident. The beds, in this instance, were on opposite sides of the room. The remaining cases, Nos. 9, 4, 6, were each in separate tents close to the Bungalow.

These two Bungalows share the latrine marked B, each using the half nearest to them.

Taking the two groups, A and B, together, I came to the conclusion that the evidence distinctly pointed to the means of infection being in the latrines, although the question of personal infection could not be altogether eliminated. Accordingly the following sanitary measures were instituted :—

The three Bungalows, Nos. 2, 3 and 5, were thoroughly washed out with perchloride solution 1 in 1,000, the walls being washed up to a height of 6 feet. The pans of all the latrines situated in the Lines were changed, the old pans being broken up and burnt. All the latrine seats were scrubbed with perchloride solution, and subsequently washed daily with hot water and washing soda.

A 5 per cent. solution of crude carbolic acid was issued to all latrines, and the sweepers were instructed to pour a half pint of this solution into each pan ; moreover, they were to clean each pan every time it was used, and again pour in a half pint of the solution.

All filth-carts and receptacles were disinfected by heat, fires being lit inside the Crowley carts, and the iron receptacles brought to a red-heat over a fire.

All the urinals were vacated and temporary urinals taken into use pending the thorough cleaning and disinfection of the old ones.

The latrine staff was increased to enable these measures to be thoroughly carried out.

These precautions were strictly executed for thirty-one days, and as no more cases of enteric were admitted during this period they were then discontinued. It will be noticed that the Bungalows Nos. 4 and 7, in which the isolated cases of enteric occurred, were not washed out with perchloride solution, although their latrines were treated. They were left as a control test to see if personal infection was taking place, and in neither Bungalow was there any spread of the disease from the original cases. While evidence may point to a source of infection being in a latrine, the practical point is, how were the men actually infected. In this case infection by the agency of flies can be disregarded, as flies were practically non-existent. I believe that these cases were infected by actual contact with the enteric bacillus while sitting on latrine seats that had previously been fouled by a commencing enteric. It is quite easy to understand how the bacillus could eventually be carried to the mouth from infected bodies or clothing. My reasons for thinking this are two, primarily the inherent laziness of the Indian sweeper, who shirks his work at every possible opportunity, especially if supervised by a slack sanitary orderly, hence imperfectly cleaned latrine seats. Secondarily, the authorised latrine staff is quite insufficient in numbers to enable the washing of latrine seats as a daily routine to be properly carried out, as well as the general cleaning work.

CARIES DENTINE IN THE ARMY.

By Lieutenant-Colonel J. G. MACNEECE.
Royal Army Medical Corps.

The loss and wastage due to caries dentine and cementum in the British Army is very large, and was particularly so in the South African War, where at Pretoria, and other large centres, thousands of men were found unfit for trekking towards the end of the war. Articles by the late Director-General, Sir W. Taylor, M.D., K.C.B., K.H.P., and other officers, have appeared in the Journal on the subject, and various suggestions have been made. In the following article I propose to discuss the question and to suggest a procedure which may help officers to deal with the various phases of caries dentine in a soldier's service, first suggesting certain rules for general guidance, promising that circumstances such as length of service may cause their relaxation, or the reverse.

Proposed Suggestions.

General.

(1) *Sound Teeth. Molars.*—Two on each side should be in apposition. Total, eight; where few, or any premolars are present, other teeth comparatively sound.

(2) *Molars.*—One on each side of jaw and opposing. Total, four molars; at least two opposing premolars on each side, and in apposition, other teeth comparatively sound.

(3) *Premolars.*—All premolars, and other teeth except molars, present and sound, last molars (wisdom) not having erupted, and which would be presumably sound.

(4) *General.*—Decayed and deficient teeth: over ten to disqualify, if physique inferior, and not likely to develop.

The perfect adult mouth should contain thirty-two sound teeth. One seldom finds this perfection (in the young soldier of 18 to 20 years, the wisdom teeth have not yet appeared); if town bred, or brought up on a diet of bread and tea, five to eight are decayed or deficient, probably more.

In the physical examination for commissions in the Army, the rule for guidance is, twenty-two teeth must be sound, or so well stopped as to be approximately sound; dentures must be surplus.

Application of Rules.

Great care and judgment should be exercised, and the above suggestions should be the minimum in the case of inferior physique, or if the incisors show signs of premature decay. When the chest measurements and physical development are good, and the alimentary canal working satisfactorily, the medical officer may relax, especially when the recruit has good dentures, and is likely to become an efficient soldier.

Under Three Months' Service.—Many recruits on the borderland are passed into the service, and here it is that the conscientious medical officer in charge of troops can exercise a beneficial influence by carefully inspecting all recruits joining from the depôt as to physical fitness. Those with caries dentine are sent to the dental surgeon for treatment, who should also express an opinion as to the lasting benefits of treatment. The medical officer brings these recruits to the notice of the principal medical officer at his monthly inspection, when it is decided whether the recruit will be retained in the service or not.

Fit for Service Abroad.—At the age of 18 for some stations, and 20 for India, Ceylon, Hong Kong, Mauritius, Singapore and West Indies, the young soldier has to be ready for Colonial and Indian drafts, and to undergo a searching physical examination, which should include the teeth. Here the soldier is likely to be three years or more abroad, and from various causes his teeth may become decayed or removed. The above rules are again recommended, always taking into consideration the physical fitness of the individual, and the fact that now in most divisions there is a surgeon-dentist available for stoppings, fillings and scrapings, which will render decayed teeth sound for a time. The question of dentures comes in here, and if the soldier possesses well-fitting false teeth and is a careful man, he should be passed for foreign service.

What is to become of those soldiers considered unfit for foreign or active service? In my opinion they should be invalided out of the service, unless a class could be formed in the Army Reserve for home service and defence only, to which they could be detailed. Their military training would not then be lost.

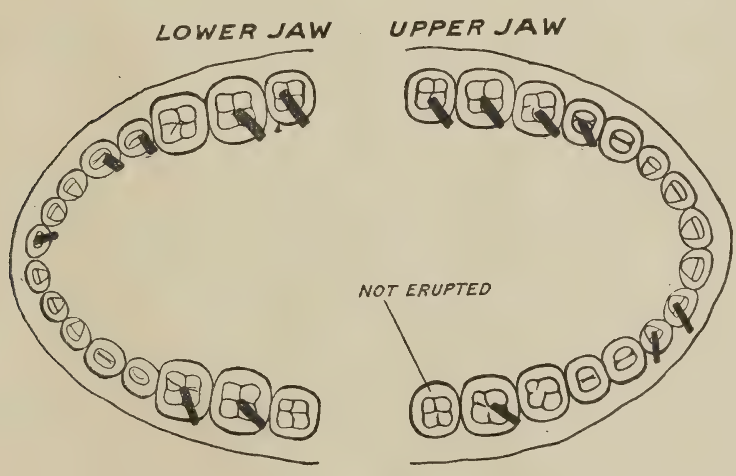
Extension of Service to Eight Years with the Colours.—The same remarks apply to this class as in the case of examination for foreign service, as they are liable for it.

Examination of Sergeants to extend their service or re-engage for twenty-one years, or who may be considered desirable to retain by their commanding officers for the good of the Service. In the

case of these non-commissioned officers, Army Order 166, of 1903, provides that on the recommendation of a medical officer, their commanding officer, and the principal medical officer of the district, they may be supplied with artificial dentures. Their mouths should be prepared by the Army dentist, all decayed teeth, &c., extracted; and the medical officer should carefully examine the man's mouth a fortnight at least after the dentures have been fitted, to ascertain that there is no pressure, that the teeth to which the plate is attached are sound, and that the food can be properly masticated. In my opinion there should be no hesitation in supplying dentures to good non-commissioned officers, who are the backbone of the Army and anxious to serve for their pension.

If England is to have an efficient Army, besides tropical diseases, two great factors have to be considered, syphilis and caries dentine, which are frequently concomitant.

When preparing Army Form B, 179, a hectographed plate showing all the teeth in both maxillæ should be attached, and those which are decayed, deficient, or not erupted, marked thus :—



This could also be prepared by the dentist and attached to the Medical History Sheet, in the case of those soldiers who are supplied with stoppings, dentures, &c.

Since writing the above, recruits are enlisted for nine years with the Colours and three years with the Reserve.

Authority has been given for enlistment of recruits who might

be considered ineligible owing to deficient or defective teeth, who will be accepted if the provision of artificial dentures is likely to render them efficient, on their agreeing :—

(1) To pay on enlistment a sum not exceeding £3, or

(2) To be placed under stoppages until the sum required to provide the dentures has been made good.

(3) To undertake to maintain their artificial teeth in serviceable condition, at their own expense, during their period of service.

It has also been decided that a soldier who incurs such loss of teeth as would cause his discharge as an invalid, may be provided with artificial dentures at his own expense (at a cost not exceeding £3), if, in the opinion of an officer of the Royal Army Medical Corps, he will be rendered efficient. He must also undertake to maintain his artificial teeth in a serviceable condition, at his own expense, for the period of his service, and the dentures must be obtained from a source approved by the military authorities.

NOTE ON AN UNUSUAL CAUSE OF ENTERIC FEVER INFECTION.

By Lieutenant-Colonel R. H. FIRTH.
Royal Army Medical Corps.

Any circumstances which explain the incidence or causation of enteric fever must be always of interest. In this connection, the facts reported as to the origin of certain recent cases of enterica in the Aldershot Command are of special importance. While the actual details were worked out by Captain Gallie, I am indebted to Major Elkington, the Sanitary Officer, for a summary of the reported facts. On October 14th, 1904, a man of the Bedfordshire Regiment was found to be suffering from enteric fever. The source of infection in this case appears to have been at Colchester, from which garrison the man had come, some fourteen days before feeling ill. This man remained in his quarters for some few days before reporting sick. On October 31st another case of enterica was noted in the case of a bugler, aged 15, belonging to the same regiment, and who had arrived in the Command with the battalion on September 23rd, and, presumably, contracted the disease locally, as he had not been away since his arrival.

An analysis of the local conditions indicates that the water supply cannot be reasonably suspected, as it is derived from an Artesian well, and in no way liable to pollution. In a similar manner the milk supply is not open to suspicion, as the dairy from which it is obtained was found to be in a good sanitary state, and, moreover, the regimental arrangements secured scalding of all milk before issue. The possibilities of the lad having acquired infection by means of casual purchases from hawkers are remote, as itinerant vendors are not allowed within the lines, and the season of the year was against the chances of drinks being sold by these dealers on the adjacent road. No sanitary defects were known to exist in the actual huts and barracks. A water carriage system of sewage removal is in use, the drains discharging ultimately into a septic or digestive tank, some 60 yards distant from the hutments. This tank is covered and surrounded by a palisade of wood some 9 feet high. From this tank the sewage is conducted by iron pipes to a Stoddart's Filter, after passing through which the sewage effluent is passed on to land. This irrigation ground is rather more than 150 yards distant from the nearest occupied quarters. The habits

of the boy were closely investigated. He had not been on furlough since he arrived in the garrison, nor had he frequented drinking houses in the camp or vicinity. On close examination, Captain Gallie found that the band boys of this battalion sometimes drank from a stream in the neighbourhood of Oxney Farm, but as this water had been very generally used by troops during the past summer without any suspicion or doubt as to its quality, there is no reason to attribute the infection in this case to its consumption. In the face of these negative facts, it was difficult to explain satisfactorily the origin of this case of enteric fever. Captain Gallie, however, recalled the fact that on October 15th it was discovered that some one had broken into the Stoddart Filter enclosure and displaced the spreaders. On examining closely the other boys in the barrack room in which the patient had also been quartered, he obtained the important admission from them that they, including the patient, were the culprits, not only having broken into the enclosure but displaced the spreaders. On their return to their barrack room to tea, they washed their hands because they were dirty; but on talking over their escapade they realised that they might get into trouble. The consequence of this was that the boy Taylor (the patient) volunteered to go down to the filter and replace the spreaders. He did so, and returned to the barrack room for his tea, apparently not re-washing his hands. It is noteworthy that none of the other boys who damaged the filter have developed any symptoms of disease.

These are very interesting facts and it is legitimate to infer that to the handling of the sewage spreaders, without washing his hands before eating, the boy, who alone contracted enterica, owes his attack of the disease. The question at once arises, was it possible for the sewage, reaching the filter by the spreaders, to have contained specific enteric material? Yes, it was possible. An undoubted case of enteric fever had been recognised from these very lines on October 14th, and he had been ailing for a few days before reporting sick; in other words, his specifically tainted excreta had been passing into the sewage installation for three or four days at least, before these boys interfered with and handled the sewage distributors. It has long been recognised that the conditions existing in a septic tank and in biological sewage installations generally were not necessarily inimical to the survival of the specific organism of enteric fever; but I am not aware of any exact observations ever having been made of the direct passage of the *B. typhosus* through such an installation, and its isolation from either the septic tank

effluent or from the filter effluent. Horrocks and I long ago planned such an experiment, but circumstances prevented our ever putting it into effect. This case appears to me to confirm very forcibly the view which we both held as the outcome of our experiments on the viability of the enteric bacillus in soil and sewage,[1] that this specific micro-organism would survive passage through a biological sewage installation. The only exact experimental observations in support of this view are those of Houston, made for the Royal Commission on Sewage Disposal.[2] In these experiments *B. pyocyaneus* was added deliberately to sewage, both at Hendon and at Leeds : at the former place as the sewage flowed on to a continuous filter of the Ducat type, and at the latter place as it flowed into a septic tank preliminary to contact beds. In the case of the continuous filter bed, *B. pyocyaneus* appeared in the effluents within *less than ten minutes* from the start of the experiment, and was present, at first invariably, later at irregular intervals, up to the tenth day. In the case of the septic tank and contact bed, *B. pyocyaneus* appeared in the septic tank liquor *within two and a half hours* from the start of the experiment, and in the contact bed effluents at the earliest possible times, that is, the first emptying of the bed. The organism was recovered from both the septic tank liquor and from the contact bed effluent as late as the ninth day. These are very striking results and absolutely consistent with the view taken as to the origin of this case of enteric fever at Borden, Aldershot.

The more important lessons to be drawn from this case are : (1) the prime necessity of scrupulous care in the sterilisation of all discharges from the enteric sick ; (2) the danger which exists from an undetected case of enteric fever, and the need of the earliest possible detection of these cases ; (3) that biological sewage installations, although yielding very good effluents chemically and bacteriologically, cannot be trusted to remove the elements of potential danger to health ; (4) the undesirability of locating sewage works in places at all accessible to the inquisitive and irresponsible.

For the elucidation of the important sequence of events relating to this case, the fullest credit is due to Captain Gallie, in whose sanitary charge the barracks were.

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[1] *Brit. Med. Journal,* September 27th, 1902, p. 936.

[2] Report of the Commissioners appointed to Inquire and Report on the Treating and Disposing of Sewage, 1904, vol. iii., p. 79.

THE ROYAL ARMY MEDICAL CORPS FOR INDIA.

By Major J. R. FORREST.
Royal Army Medical Corps.

It cannot be denied, and it has in fact been admitted from the earliest times, that climate is a potent factor in the history of human development. Especially does climate influence the activity of men's minds. Who does not remember reading of the stupid Bæotians living in their close and hot valleys? The *dolce far niente* of the Italian is proverbial. The more northern races give the impetus to trade and progress the world over. Yet it cannot be doubted that residence in a tropical country has a sobering, not to say retrogressive, action even on the most energetic of our races, and makes them only too ready to acquiesce in a policy of *laisser faire.* All which preamble is intended to be introductory to the remark that the mills grind exceedingly slowly in India, and, to come to the point, that the means of nursing the sick in that country are much as they were fifty years ago. Now, stated briefly, we have in large station hospitals in India, Assistant Surgeons (the Indian Subordinate Medical Department), Lady Nurses (Queen Alexandra's Military Nursing Service for India), the Native Army Hospital Corps, and British Nursing Orderlies. The Army Hospital Corps are graded into ward boys, cooks, sweepers and water carriers. The British Nursing Orderlies have, some of them, been instructed, more or less, by the Nursing Sisters, been examined by an officer, R.A.M.C., and get "certificates." A "certificated" orderly gets four annas a day extra pay. The remaining "nursing" orderlies may be regarded as mere common labourers, and are without any knowledge of nursing. During the enteric season, or in the instance of any serious case, application is made to the Commanding Officer of a British regiment for nursing orderlies. Then the troubles of the Officer Commanding the Station Hospital begin. He has no place wherein to house them. They go to their barrack-rooms and after a turn of night duty they can naturally get no rest there. Then in a few days an intimation is received from the Officer Commanding the Battalion that Privates So-and-so are needed to go through their course of musketry. Substitutes are sent, very often no more "certificated" orderlies are available. Then the Sisters complain that the men do not know any of the duties expected of them. Next, after a short interval, another memorandum comes from the Officer Commanding the Bat-

talion that Privates So-and-so are needed for field training, or the Lieutenant-General Commanding is going to inspect the troops, and all ranks are to parade as "strong as possible," and a piteous appeal comes from the Officer Commanding the Battalion. So much for the British Nursing Orderlies, who are, as has been stated, our mainstay in serious cases. As regards the Army Hospital Corps, I think there can be but little doubt that the class of ward-boys are unreliable and unskilled and ought to be abolished, so far as their nursing duties are concerned. A few might be retained for trimming lamps, scrubbing tables, &c. The cooks are eminently unsatisfactory, know little or nothing of cooking, and are an endless source of trouble, owing to their dirty and often drunken and dishonest habits. In these times, when cookery schools are established for British soldiers, and the British soldier is gradually being taught to cook for himself in barracks, it is surely an anomaly that so little attention should be given to cooking for the sick. Sweepers and water-carriers it would be necessary to retain. Now, who are to take the place of British Nursing Orderlies and the ward-boys of the Native Army Hospital Corps? Unquestionably we should be infinitely better off with N.C.O.s and men of our own Corps, the Royal Army Medical Corps. We should then have reliable nurses, cooks and compounders. The Assistant Surgeon, who is generally a Eurasian, is strictly ordered to do all compounding himself, but I maintain that he very often does it unsatisfactorily, and I think that many officers will admit that they have come across cases where the compounding has been done by a ward-boy assisting in the dispensary. We should certainly gain immensely in the matter of discipline if we had the R.A.M.C. in hospitals in India. Without a shadow of doubt the British soldier has no respect for the Assistant-Surgeon, and no added rank will make him respect a man who is not of his own colour. The Assistant-Surgeon, formerly known as the "apothecary," and still so named by the soldier, has, on joining, the rank of a warrant officer. The senior grades have honorary commissioned ranks. The British soldier will not obey one who is, to put it plainly, *pace* the late Lord Salisbury, a "black man," and discipline is consequently hard to maintain. Then, to come to the financial question, I think it would probably be found that with the abolition of the Assistant-Surgeon class and "certificated" nursing orderlies, it would be no more expensive to give us the R.A.M.C. It is true that the Assistant-Surgeons are also available for civil employment. But that is another question. Let the civil authorities maintain as many as they require for their own purposes.

SHOULD SOLDIERS BE SUPPLIED WITH DENTURES?

By Major H. P. JOHNSON.
Royal Army Medical Corps.

Not only is the supply of dentures to the rank and file a source of great expense to the Government, but also false teeth will prove a marked cause of inefficiency on active service. There is no question that non-commissioned officers, if they require dentures, should be supplied with them at the public expense; but the private soldier, when "fed up" with active service, will in nine cases out of ten, purposely break his plate, and thus ensure his being invalided to the base. I have spoken to a good many regimental officers on this danger, and they all agree with me that it is a very real one. As regards the plates supplied—I am speaking of India only—they are in no way superior to the vulcanite sets made by leading London dentists, at a cost of two to three pounds; and I have recently had to return seven or eight practically new plates for repair. Again, the processes of extraction of the teeth, preparing the patient's mouth, and fitting the plate, occupy a period of at least three months; and as during this interval he is in an edentulous condition, he is useless for active service, or even for manœuvres. During the last six months I have forwarded one dental surgeon 2,667 rupees on account of dentures for twenty men. This gives an average cost of nearly £9 per man. In addition to this amount, the bill for fifty-two men has not yet reached me, and as the dentist for these men had to travel some hundreds of miles twice during the season, and also to remain a week in the station on each occasion, it is very evident that his charges will be considerably more than double the former bill. The medical officer whom I succeeded told me that he had already forwarded cheques for nearly 5,000 rupees on account of dentures for the men of the regiment. From these figures it would appear that in India the cost of supplying plates for the men of one regiment is very nearly £1,000; and it must not be forgotten that this amount is not final, as every year a certain proportion of the new drafts will require false teeth, and many of the old plates will need repair.

The only treatment for a soldier whose teeth are so bad that a false plate is necessary is to invalid him; and to give him the option, provided he is of good character and fulfils other requirements as to length of service, &c., of obtaining a plate at the public expense subsequently.

The question remains as to what should be done for the men whose teeth are not so bad as to necessitate discharge from the service; and here in India there is a very simple solution of it. All the Assistant Surgeons, educated at Calcutta, receive a very thorough course of instruction in dentistry, and when they leave the college most of them are quite competent to stop teeth and make artificial plates. Eight or ten of the most able dentists amongst them should be seconded, and given staff pay of, say, 100 rupees per month, with travelling expenses, in order that they may visit, quarterly, all the stations for British troops, and examine the teeth of the soldiers; stopping permanently those which require it, and advising the medical officers as to the invaliding of those men whose teeth are too bad to be stopped. Only non-commissioned officers, and, possibly, a very few especially valuable privates, should be supplied with plates. The apparatus necessary would, of course, be supplied by the State. Should this suggestion be put into practice, I am convinced it would save the Government many thousands of rupees yearly, and greatly enhance the efficiency of the troops.

Clinical Notes.

PORTAL PYÆMIA.

By Major J. FAYRER.
Royal Army Medical Corps.

With the kind permission of the officiating Senior Medical Officer, Captain Clarke, R.A.M.C., of Hounslow, and Dr. Christian, Civil Surgeon, I publish this most interesting case.

I do so, thinking that all cases of peculiar interest should be described. The excellent notes of the case are taken verbatim from the Medical Case Sheets sent by Dr. Christian, who was in medical charge.

Notes from Medical Case Sheets.

No. 8780, Private H. H., age 19, service eleven months, 2nd Battalion Middlesex Regiment.

February 10th, 1904.—Admitted to hospital complaining of pains all over, worse in back and round neck. He states that he has been feeling ill for three days. Temperature 100° F. Tongue dry and furred down centre, cleaner at margins. Tonsils and posterior pharyngeal wall somewhat congested. Bowels not open. Ordered calomel grs. iv., and mist. sod. salicyl. grs. x. to ℥i. every four hours.

February 11th, 1904.—Had a restless night. Temperature 100° F. Pulse 82. Tongue very dirty. Breath foul. Throat rather more congested. Bowels acted after calomel. Motion yellow colour. Under the skin of the abdomen there are numerous dull spots of a purple tint, very indistinct, and about the size of a split pea.

Evening: Temperature 101° F. Condition much the same.

February 12th, 1904.—Another restless night. Temperature 100° F. Tongue dry and brown down the centre, white and furred down margins. Had a rigor at 11 a.m., after which the temperature rose to 103° F. Pulse 84. Conjunctivæ yellow.

Evening: Temperature 101° F. Pulse 88. Feels very ill. Vomited twice after milk. Spots on abdomen still apparent, but have not got more marked.

February 13th, 1904.—A bad night. Two rigors between 11 p.m and 2 a.m. Temperature this morning 101° F. Pulse 82. Follicular patches on both tonsils. Breath very foul, tongue furred. Vomited twice after milk and soda water given in small quantities. Ordered gargle of pot. chlor. and throat to be painted with liq. ferri perchlor. and glycerine. The conjunctivæ are of a deep yellow and the skin is slightly jaundiced.

Evening: Had another rigor at 2 p.m. Temperature rose to 103° F. Throat slightly better.

February 14th, 1904.—Temperature 100·8° F. Has had a restless night. Throat slightly better. Vomiting still continues occasionally. Bowels acted, motion pale. Urine contains bile, no albumen. Skin more yellow. Liver dulness extends about an inch below costal margin. No tenderness over liver. Spleen not enlarged.

Evening: Temperature 101·4° F. Pulse 86. General condition much the same.

February 15th, 1904.—Morning temperature 102·4° F. Pulse 96. Condition much the same. Tongue still dry and furred. Throat still shows follicular patches. Breath very foul. Skin has a peculiar odour of bile.

Evening: Temperature 102·8° F. Has had rather a better day. Condition, however, remains much the same. Specimen of blood sent to laboratory for Widal's reaction.

February 16th, 1904.—Had a bad rigor at 1 a.m. Temperature rose to 103·8° F. Pulse 88. Vomiting still persists. Peptonised milk given in small quantities and retained fairly well. Liver dulness increased downwards. Complains of no pain on palpation, but states he occasionally has pain in region of umbilicus shooting upwards towards liver. Pulse weak, ordered ½ oz of brandy, to be repeated if necessary.

Evening: Temperature 101·6° F. Pulse 96. Had a simple enema. Motion solid and light yellow. Throat better. Tongue very dirty. Ordered salol grs. x. every four hours. Retains nourishment and brandy fairly well.

February 17th, 1904.—Had a bad night. A rigor lasting thirty minutes at 1.15 a.m. Temperature afterwards was 104° F. Vomited once during night and was very restless. Temperature this morning 102° F. Pulse 90 and rather weak. Skin of a deeper yellow. Bowels not open.

Evening: Had another rigor at 6 p.m. Temperature 103·4° F. Pulse 124. Respirations 34. General condition bad. Word received from laboratory stating no reaction.

February 18th, 1904.—Temperature 102° F. Had a severe rigor at 11.45 p.m. Temperature afterwards 104·6°, another rigor at 6.15 p.m. Temperature afterwards 105·2°. Pulse 117. Sponged after each attack, which reduced temperature by about 2°.

Evening: Has had three rigors during the day. Temperature at 6 p.m 105·2°. Sponging again reduced temperature. Vomiting not so frequent. Throat still shows white patches but appears somewhat better. Given an injection of anti-streptococcic serum this morning. Throat is better this evening, tongue dry and brown. Ordered calomel grs. iv.

February 19th, 1904.—Had practically no sleep last night. Had a very severe rigor lasting more than an hour at 1 a.m. Temperature

afterwards rose to 105·6° F. Pulse 122. Sponged again to reduce temperature, which fell considerably. Temperature this morning 104° F. Pulse 144. Respiration 46. Bowels acted, motions solid and light yellow. Vomiting occasionally. Liver dulness further increased, and now extends about 2½ inches below costal margin. Swelling is uniform, with no special point of tenderness.

Evening: a little better. Temperature 101·4° F. No rigors during day. Skin moist, perspiring freely. Pulse 112. Respiration 32.

February 20th, 1904.—Had a better night. Slept for about five hours. No rigors during the night. Feels better. Temperature 100·4° F. Pulse 112, rather weak. Respiration 30. Throat better. Tongue dry, complains of great thirst.

Evening: Not so well. Temperature 103·8° F. Vomiting. Pulse 140. Respiration 36. Mustard leaf applied over epigastrium. Sponged with evaporating lotion, which cooled him. Bile still present in urine. Motions clay like. Condition otherwise remains the same.

February 21st, 1904.—Had a bad night, no sleep. Hot and very thirsty. Had a rigor at 2 a.m., temperature afterwards 104·6° F.; again sponged. Temperature this morning 100·6° F., pulse 116, respiration 32. Tongue dry and brown, skin still jaundiced. Bowels not open. At 1 p.m. he began to shiver, and got rather collapsed. Passed about 1½ pints of blood from rectum, blood-red in colour with some clots. The symptoms of collapse soon passed off, and patient began to perspire profusely. Ordered a hypodermic of morphia gr. ¼. Brandy discontinued.

Evening: Patient fairly comfortable. Temperature 99° F. Pulse 108, respiration 28. Tongue moist. Had two hours' sleep.

February 22nd, 1904.—Had a fairly good night. No hæmorrhage, rigors or vomiting. Temperature 99·8° F.; pulse 108. States he feels much better, and wants to get up.

Evening: Had a restless day, continually trying to get out of bed. Temperature 101·6° F. Pulse 132. Had a slight hæmorrhage from bowel.

February 23rd, 1904.—Condition much the same. Passed clot from bowel. No motion. Has been delirious during the night and has had two slight rigors. Skin dry and burning, thirst constant. Still states he has no pain in abdomen. Slight return of hæmorrhage from rectum. Given gr. ¼ of morphia hypodermically. Also gr. $\frac{1}{30}$ of strychnine. As I have been unable to come to a definite diagnosis on this case, and have already consulted Captain Clarke, R.A.M.C., and two other medical practitioners without being able to come to a definite conclusion, I have written to the Principal Medical Officer of the Home District, requesting him to send someone down in consultation. I have suggested that the case may be one of enteric fever complicated by some liver condition, probably of a suppurative nature; or else some primary liver condition, such as suppurative cholangitis.

Evening: Temperature 103·4° F., pulse 144, respiration 34. Is in much the same condition. Passed urine involuntarily once. Vomiting occasionally. No return of hæmorrhage.

February 24th, 1904.—Had a quiet night till 2.30 a.m., when he again became delirious. Pulse fairly good. Temperature this morning 98·8° F., pulse 124. Respiration 36. Tongue dry and brown. Seen in consultation at 3 p.m. by Major Fayrer, R.A.M.C. At this time his condition had somewhat changed. His pulse was small and rapid. He was lying with his knees drawn up, abdomen distended and tympanitic. He is very collapsed. At the suggestion of Major Fayrer an aspirating needle was passed into the liver. On the first attempt only blood was drawn off, but on the second attempt some pus of a thick caseous nature passed through the needle.

Evening: Very collapsed, pulse almost imperceptible. Given hypodermic of strychnine gr. $\frac{1}{60}$, which improved pulse. Very restless. Given hypodermic of morphia at 6 p.m. Temperature 100·2° F., pulse 148, respiration 52.

February 25th, 1904.—Very ill all night. Pulse failing. Given two injections of strychnine. Took nourishment fairly well. Does not complain of much pain, although he says that now and again he gets sharp darting pain in his right iliac region. Legs still drawn up. Abdomen tympanitic. Temperature 99° F., pulse 132.

Evening: Has been getting worse all day. Restless and delirious. Ordered an injection of morphia, as he complained of more pain in abdomen. During the night he gradually sank, and died at 2.40 a.m.

Post mortem, twelve hours after death.—Body somewhat emaciated. Conjunctivæ yellow, and showed green discolouration along the lower margins. Pericardium contained about 6 ozs. of dark brown fluid. Heart weighed 8 ozs. Valves normal. Right lung 18½ ozs., healthy. Left lung 16½ ozs., healthy. Liver weighed 6 lbs. 2 oz., adherent to under surface of diaphragm. Capsule thickened and adherent. Surface of liver showed numerous small yellow spots varying in size from a pin-head to about a quarter of an inch in diameter, and on pricking these pus exuded. Gall bladder distended and full of thick, grumous bile.

On section, the liver showed an enormous number of small abscesses, the largest being about the size of a small walnut. The stomach contained a quantity of bile-stained semi-digested milk. Kidneys and spleen normal. Large intestine contained fæces, very dark in colour, and also blood clot. Small intestine, in the region of the cæcum, showed perforation causing localised peritonitis, and commencing gangrene in the neighbourhood and in the right iliac region, and matting together of the intestines, involving the appendix. There were no typhoid ulcers on the mucous coat, but the whole of the mucous membrane of cæcum and ileum was intensely injected.

My only claim to "a say" in the matter arose as follows: Dr.

Christian having had many opinions as regards a diagnosis of the case, none of which satisfied him, and being himself at a loss as regards the exact condition of the patient, sent officially to the Principal Medical Officer, Home District, asking that a Medical Officer might be sent down in consultation. By order of the Principal Medical Officer I proceeded to Hounslow on February 24th, and saw the case with the Senior Medical Officer and Dr. Christian. Beyond determining the fact that there was pus in the liver, an opinion already held by Dr. Christian, my visit was of no use to the patient, and, I fear, but of little help to those in charge of the case.

When I saw the patient on February 24th, the following was his condition: Thin and emaciated, body generally tinged with yellow, collapsed, pulse small and rapid, abdomen somewhat distended, knees drawn up, tympanitis, the liver was uniformly enlarged, the enlargement extending, and being visible, below the costal arch.

Having carefully studied the notes of the case, the temperature chart, the condition of the pulse, frequent occurrence of rigors, &c., &c., and judging from his condition and appearance when I saw him, I came to the conclusion that not only was the liver enlarged, but that it was the seat of probably multiple abscesses; that the presence of these abscesses was the result of pyæmia; that the pyæmia owed its origin to septic infection, from either the throat or the intestines. The lad's age, service, the fact that he had never been abroad, indeed had not been out of Hounslow, reduce our choices of etiological conditions to—

(1) Septic sore throat with secondary infection of the liver. (2) Enteric fever. (3) Appendicitis.

A careful study of the notes of the case would seem to eliminate even the above in our attempts at elucidating the puzzle. But as nothing can originate without a cause, I would attempt to argue the matter out, and as the infection might possibly be the result of one, or the combination of one or two of the above conditions, I would first take them in order, discussing, shortly, the *pros* and *cons* in each case.

(1) *Septic Sore Throat with Secondary Infection of the Liver.*—It is possible, but improbable, that the condition of the liver was the result of secondary infection from the throat. The history of the case, the condition of the intestines (due to whatever cause), seem sufficient to account for the secondary hepatic trouble, and, if we know that a certain condition (whatever the cause may be) exists, which is favourable to the production of the morbid conditions we are investigating, we may, I think, dismiss a possible for a probable factor, *i.e.*, look to the intestines as the original seat of the trouble, and not the throat.

Further, I think that a study of the case points rather to the condition of the throat being a demonstration of a general intoxication. This then brings us to:—

(2) *Enteric Fever.*—Points in favour of: The temperature, a gradually

ascending morning rise from 100° F. on February 10th to 103° F. on the 18th. The pulse not increased in ratio to the temperature during the first week in hospital.

General condition: One of malaise with furred tongue, occasional vomiting and constipation. Sore throat. Rash. An eruption of dark isolated spots on abdomen. Hæmorrhage from the bowel on what was probably the fourteenth day of the disease.

Points against: Rash appeared on second day after admission and was not typical in appearance. Spleen not enlarged. Widal's reaction gave negative results. *Post-mortem* examination showed absence of typhoid ulcers.

(3) *Appendicitis.*—In favour of: *Post-mortem* appearances pointed to what might have been a rapid gangrenous appendicitis, without time for the formation of an abscess.

Points against: During his illness the symptoms in no way pointed to appendicitis; no pain in right iliac region, no swelling; the pulse rate was also against appendicitis during the first week.

As a result of the above attempt at a differential diagnosis, we are brought to an "impasse"—we seem, so to speak, blocked—but as the *post-mortem* examination gives us the accurate diagnosis of the disease, and cause of death, viz: *Suppurative Pylephlebitis or Portal Pyæmia*, any further attempts at arriving at the correct etiology of the condition must be made by investigating the causes of portal pyæmia as we know them, in fact, we must work backwards.

The causes of portal pyæmia are:—(1) Suppurative appendicitis. (2) Ulceration of the intestines, especially dysentery. (3) Malignant ulceration of stomach or intestines. (4) Chronic gastric ulcer. (5) Ulcerative diseases of the rectum. (6) Suppuration of gall-bladder. (7) Ulceration from gall stones or suppuration. Hydatid cyst. (8) Foreign body which has been swallowed and has penetrated portal vein: (such cases are on record). (9) Phlebitis of the umbilical vein in the new born.

From this exhaustive list we can at once eliminate all but No. 1, *i.e.*, Suppurative appendicitis. This reduces the diagnosis to:—(1) Portal pyæmia the result of: (*a*) Enteric fever, or (*b*) Appendicitis.

Now it seems to me that we must discard completely enteric fever as the cause. *Post-mortem* evidences alone are sufficient to justify this step.

We are therefore reduced to appendicitis as the cause of all this trouble, and my opinion is that the lad had, *de novo*, an attack of acute appendicitis, transient possibly in its effects, but which was followed by recurrent attacks in a sub-acute form, the insidious but virulent nature of the condition being probably intensified by "auto-intoxication" through the intestine, the result of constipation possibly, the first symptoms described, viz., headache, pains in the neck, sore throat and presently the rash, being the actual demonstration of a general, though insidious,

intoxication. Following this, one would naturally expect the metastatic infection of the liver. I would give it as my opinion, therefore, that the case was one of suppurative pylephlebitis, following suppurative appendicitis.

[*See* "Hygiene and Diseases of Warm Climates," by Davidson, p. 631, plate 3.—Ed.].

NOTES ON CASES OF ABSCESS OF LIVER WHICH WERE ADMITTED TO STATION HOSPITAL, CAIRO, FROM 1898 TO 1903.

By Lieutenant-Colonel C. R. WOODS.
Royal Army Medical Corps.

No. 1.—Private ——, 1st Seaforth Highlanders, aged 27, seven years service, had suffered from dysentery in India and Egypt. Admitted to hospital May 27th, 1898, suffering from intermittent fever, loss of flesh, pain in the side and constipation. The liver was slightly enlarged, the skin sallow, tongue furred, and the abdominal walls became rigid on attempting to palpate the liver. On June 1st pus was discovered on aspiration of the right lobe of the liver through the seventh intercostal space in the axillary line. A portion of the eighth rib was removed, the abscess opened, and a large quantity of dark coloured pus was evacuated. Very free bleeding ensued, but was stopped by plugging. The plug was removed next day and the abscess cavity irrigated. The patient progressed favourably for the next few days, but a subacute attack of dysentery came on, and the patient finally succumbed to exhaustion on July 7th. The *post-mortem* examination disclosed, besides a large abscess in the right lobe which had been opened, several smaller ones scattered through the right and left lobes. Dysenteric ulcers were numerous in the colon.

No. 2.—Private ——, 1st Cameron Highlanders, admitted to hospital August 1st, 1898, suffering from dysentery. In spite of treatment he made no satisfactory progress, and died on September 21st. At the *post-mortem* examination, besides the dysenteric ulcers in the large intestines, were found two abscesses in the liver.

No. 3.—Private ——, Royal Welsh Fusiliers, aged 23, five years service, admitted to hospital January 23rd, 1899, suffering from the effects of a severe kick of the stomach received while playing football. He remained in hospital suffering from obscure symptoms, cough, pain, and evening rise of temperature, with slight enlargement of both liver and spleen. On February 27th pain over the liver was severe and there was frequent cough. Aspiration through the eighth intercostal space in the mid-axillary line disclosed pus, and an abscess in the right lobe of the liver was opened, after resection of a portion of the rib. A large quantity of pus was evacuated with relief to symptoms. On March 30th

the temperature began to rise, owing to the drainage tube becoming blocked; the opening was enlarged and a fresh tube was put in. The temperature fell to normal again and the patient made a good recovery, leaving hospital for England in May, 1899.

No. 4.—Private ——, R.A.M.C., admitted to hospital August 5th, 1898, suffering from diarrhœa, intermittent temperature, sleepless nights, furred tongue and enlarged liver. He had a history of former dysentery. On September 12th, 1898, pus was found on aspiration, and incision made into liver. A large quantity of pus was evacuated, a drainage tube was inserted, the abscess cavity gradually contracted and the patient made a good recovery, leaving for England October 30th, 1898.

No. 5.—Private ——, 1st Cameron Highlanders, aged 23, four years service, admitted to hospital June 26th, 1899, suffering from hepatitis. On August 1st liver was enlarged and tender, and an attempt was made to find pus in the liver by aspiration, but unsuccessfully. The patient's condition, however, did not improve, vomiting set in and another search was made on August 4th, this time successfully. An incision was made into the liver between the seventh and eighth ribs, and a large abscess evacuated. The patient, however, did not improve, but gradually sank, dying on August 10th, 1899. The *post-mortem* examination showed several abscesses in the right lobe, one of which had burst into the pleura; two smaller ones had coalesced, and had been drained at the time of the operation.

No. 6.—Private ——, Cameron Highlanders, admittedFebruary 15th, 1899, suffering from pain in the right shoulder, fever, constipation, and later on pain over the lower border of the liver. On February 28th, March 4th, and March 10th, he was aspirated in several places, but no pus found. On March 13th, however, the liver was constantly enlarged, and much pain complained of. The liver was again carefully explored with the aspirator and pus found in the right lobe. The abscess was evacuated by an incision through the ninth intercostal space. The patient died on March 15th, and at the *post-mortem* examination, numerous abscesses were found in both lobes.

No. 7.—Private ——, A. S. Corps, aged 23, service two years, admitted August 1st, 1899, suffering from fever, loss of appetite, and vague pains. There was a previous history of dysentery, but at this time no enlargement of, or tenderness of, the liver was present, the abdominal muscles became rigid on palpation, and there were large cutaneous veins over the abdominal walls. On September 15th the right lobe of the liver was explored with the aspirator, between the seventh and eighth ribs, and pus found. A free incision was made and a large abscess evacuated. Temperature became normal but discharge continued. On September 20th an attack of dysentery came on, and on September 25th he complained of great pain and shortness of breath. He now suffered from collapse, frequent vomiting, and died on October 4th, 1899. The *post*

mortem showed abscess in right lobe of liver invading diaphragm and lung. The abscess had been opened but the cavity was not contracted, owing to adhesions to diaphragm and right lung, the neighbouring part of which was inflamed. The large intestines showed several dysenteric ulcers.

No. 8.—Sergeant ——, M. M. Police, admitted to hospital September 2nd, 1900, for hepatitis; pus found in right lobe of liver September 13th, 1900, and an incision was made into the abscess through the seventh intercostal space. He died on September 20th, 1900. Two abscesses were found in the right lobe, and one in the left lobe.

No. 9.—Gunner ——, Royal Artillery, admitted October, 1900. There was an old history of dysentery. Symptoms of abscess of the liver were present, and pus having been found in right lobe by aspiration, the abscess was opened by incision just below border of ribs on the right side, and a large quantity of pus evacuated, but patient died on October 30th from exhaustion and concurrent dysentery. No *post mortem* was made.

No. 10.—Private ——, 11th Hussars, aged 27, seven years service, eight months in Egypt, admitted to hospital July 8th, 1900, suffering from pain over the liver, no vomiting, no jaundice. A friction sound was heard over the eighth intercostal space. On July 23rd, 1900, as the pain had become more severe and of a stabbing nature, the right lobe of the liver was explored and pus found. A free opening was made, a tube inserted, and cavity of the abscess well drained. Satisfactory progress was made till August 6th, when the temperature began to rise, but next day a profuse discharge took place from the wound with amelioration of all his symptoms. It is supposed another abscess had burst into the one originally opened. He became convalescent and was sent to England October 31st, 1900.

No. 11.—Private ——, aged 27, five years service, one year in Egypt, admitted to hospital July 27th, 1900, suffering from pain in the back and fever, scanty dark coloured urine, stationary pain over liver. On August 11th, 1900, he was aspirated, and pus found in right lobe of liver. Abscess incised and drained through seventh right intercostal space. Another abscess was discovered, six inches posterior to the first incision; this was also evacuated. The patient did badly for a few days after this double operation, and was delirious on August 13th, but gradually recovered, and as the abscesses had healed he was sent to England October 31st, 1900.

No. 12.—Private ——, 11th Hussars, admitted to hospital July 20th, 1900, with evident signs of abscess of liver. There was a previous history of dysentery. Aspiration, pus found in right lobe, abscess opened into and drained, made an uneventful recovery, and went to England October 31st, 1900.

No. 13.—Gunner ——, Royal Artillery, admitted to hospital May 20th, 1901, with obscure feverish symptoms; right lobe of liver aspirated and pus found. The abscess was opened by free incision between the seventh

and eighth ribs, and a large quantity of pus evacuated. He appeared to be relieved by the operation, but he died on July 15th, 1901, from dysentery, and at *post mortem* two small abscesses were found in left lobe, besides the one originally operated on.

No. 14.—Private ——, Seaforth Highlanders, admitted to hospital November 1st, 1901, suffering from abscess of liver. He was at the time in a critical condition. He was operated on, and pus evacuated, but he never rallied, and died on November 7th. There was an old history of dysentery. No *post mortem* was made.

No. 15.—Private ——, Military Police, admitted November 24th, 1901, for symptoms of abscess of left lobe of liver. The abscess was incised and drained through the abdominal walls on November 26th, 1901. He made a good recovery, and left Egypt for England in January, 1902.

No. 16.—Private ——, 11th Hussars, aged 27, seven years service, two years in Egypt, had had dysentery formerly. Admitted on December 10th, 1901, suffering from symptoms of abscess of liver. Operation by incision and drainage through seventh intercostal space on December 10th, 1901, and made a good recovery.

No. 17.—Lance Corporal ——, Seaforth Highlanders, aged 24, two years service, two years in Egypt, admitted to hospital September 29th, 1901, after having suffered from an attack of enteric fever. He was found to present symptoms of abscess of liver. He was operated on on June 26th, 1902, by resection of portion of seventh rib, just external to vertical nipple line, and 26 ozs. of pus were evacuated from the right lobe of the liver. A second operation was performed on July 3rd, 1902, and contents of another abscess evacuated, and a third abscess was operated on on August 13th. The patient bore these different operations well, and his condition improved after each, but the improvement was not permanent, and he died on September 24th, 1902. *Post-mortem* examination showed multiple abscesses in the liver in both lobes.

No. 18.—Private ——, Leicester Regiment, aged 24, two years service, one year in Egypt, was admitted to hospital on August 3rd, 1902, suffering from pain in the side, and on September 9th, 1902, pus being found on aspiration of the right lobe, two inches of eighth rib was removed in mid-axillary line, and abscess evacuated. Recovery was complete, and he went to England on November 30th, 1902.

No. 19.—Private ——, 3rd Royal Fusiliers, aged 26, two years service, was admitted to hospital on July 22nd, 1903, suffering from slight enlargement of liver, pain in the right side, and obliteration of the intercostal spaces on the right side. On July 26th pus was discovered by means of aspiration, just below the ribs on the right side in the nipple line. An incision was made into the right lobe of the liver through the abdominal walls, and pus evacuated. He is now (August 12th) convalescent. He suffered from dysentery at Khartoum during the present year, and was sent to Cairo for change in June.

Two cases of liver abscess in officers also came under my notice; one was operated on, portion of rib resected, and abscess drained; he made a good recovery, and served afterwards in India and Egypt, and is still serving, and apparently enjoying excellent health. The other was an officer who was invalided from the Soudan campaign with hepatitis, but in whom an abscess formed, and discharged itself through the bowel, probably the large intestines. His recovery was complete, and he served afterwards in Egypt and South Africa, and is still serving in the army.

The points of interest in these cases are :—

Etiology.—One case was probably due to injury, *vide* No. 3. One case came on after enteric fever, *vide* No. 17. Eight cases gave a history of dysentery, or showed remains of dysenteric ulcers, at *post-mortem* examination. Eight cases were apparently idiopathic, or due to slight injury to an organ predisposed by climatic influences and errors in diet to inflammation. Dysentery is sometimes present while the patient is suffering from the abscess, but generally precedes it, sometimes by years.

Pathology.—The abscesses discovered after death were of all sizes, from the large solitary abscess to multiple small abscesses varying from white dots to the size of a large orange. There were sometimes, however, one large abscess and two or three small ones. These abscesses varied much in appearance, but I saw none the contents of which had apparently become absorbed or cretaceous.

Symptoms.—The disease made itself manifest under various conditions, the symptoms being at times very obscure, and in others tolerably distinct. In most cases the symptoms ran a slow, intermittent course, but in others the disease ran an extremely rapid course, death appearing to be caused by toxæmia. In very few cases was jaundice present, and the sclerotic remained clear in most. The most constant symptoms were pain and fulness in the right side, rigidity of the abdominal muscles, slight enlargement of the liver, obliteration of the intercostal spaces, and fever, generally of a hectic type. The bowels were inclined to be constipated if dysentery was not present, and the tongue was coated with a thin, light yellow fur. Vomiting and cough were often present as reflex symptoms.

Diagnosis.—Pain, slight enlargement of the liver, rigidity of the abdominal muscles, obliteration of the intercostal space, and the absence of any other apparent disease, lead one to suspect abscess of the liver, but it is only on aspiration that the diagnosis can be cleared up, although a perusal of the above cases show that at times aspiration fails to find the matter, even though an abscess be present. Owing to severe concurrent disease, abscess of the liver may be overlooked, *vide* Case 2.

Terminations.—When the patient dies, the disease is generally brought about by exhaustion, or concurrent dysentery. Death sometimes occurs very rapidly, *vide* Case 14. If the abscess or abscesses can be opened and drained the operation is very successful, but in the case of more than

one abscess they are exceedingly hard to find, and as a rule the prognosis is very bad.

Case No. 17 is an instance in which more than one abscess was operated on at the same sitting. Treatment was unsuccessful in all cases in which the abscess burst into the lungs or pleura.

Treatment.—If we disregard the treatment of hepatitis and the dysentery that so often accompanies abscess of the liver, once that the disease is diagnosed there is but one treatment, viz., evacuation of the pus, resecting, if necessary, a portion of a rib to facilitate free drainage. The cavity of the abscess should be irrigated at the time with a weak aseptic lotion. Hæmorrhage is seldom severe, but in Case No. 1 it was severe enough to cause extreme collapse, from which, however, the patient rallied well. In some cases the wall of the abscess is so thin as to break down under manipulation, in others the abscess is more deeply situated, and in those, after a fine bistoury is passed alongside the aspirator needle (which is left in as a guide while exposing the liver), a sinus forceps is introduced, and the opening into the abscess enlarged by expanding the blades.

In the event of convalescence being retarded, another abscess may be present which can be operated on as in Case 17, or it may be due to some occlusion of the tube preventing free exit to pus, and this of course can be easily remedied. After operation for abscess of the liver the organ has a tendency to contract, and the opening into the liver to move away from the opening in the skin, and on this account it is advisable to make a slightly curved or even cross incision through the integuments.

NOTES ON A CASE OF LIVER ABSCESS, WITH SECONDARY ABSCESS IN THE BRAIN.

By Captain T. B. UNWIN.
Royal Army Medical Corps.

Private ———, aged 23, 2nd Royal West Kent Regiment, was admitted to hospital, Diyatalawa, Ceylon, on August 29th, 1903.

History.—He had been suffering from hepatitis, and discharged four days previously from Colombo Hospital; otherwise his medical history sheet was clear.

State on Admission.—The patient was poorly developed and anæmic; his temperature was 101° F. and pulse 86 per minute, the tongue clean, bowels regular and normal. He complained of slight tenderness in the umbilical region, and a sense of heaviness in the right hypochondrium. On percussion, the liver dulness was somewhat increased, reaching about half an inch too high in the nipple line, and half an inch below the costal margin. I placed him on milk diet, custard, and poached eggs. Medi-

cinally, ammonium chloride, grs. xx., three times a day. He appeared to improve under this treatment, but on September 24th he complained of pain in the right hypochondrium. Fomentations were applied over that region, and $\frac{1}{4}$ of a grain of hydrochlorate of morphia given at night. The pain subsided, but the patient was becoming thinner and weaker.

On October 3rd there was again pain over the liver area, which extended towards the right shoulder and neck, and also towards the umbilicus. He complained of night sweats. The temperature was ranging from normal in the morning to 101° at night. The pain was at no time severe, the patient allowing me to palpate and percuss him freely, but nothing definite could be made out. He took his food well, but did not improve.

On October 10th I found that the liver dulness had increased to an inch below the costal margin, and extended well over to the left side, but I came to the conclusion that a liver abscess had formed. I called in Civil Surgeon L. Brohier, Haputale Hospital, and he agreed with my diagnosis. We proposed to aspirate.

Operation. — An anæsthetic was administered, and I passed an aspirator needle slightly upwards, inwards, and to the right, just below the costal margin in the nipple line; a thin brownish fluid with threads of pus escaped. From the direction in which the needle had been passed, we came to the conclusion that the abscess was situated in the right lobe, nearer the axillary border, so another and larger aspirator needle was passed between the seventh and eighth ribs, when a quantity of thick pus escaped. An incision was made about three inches in length, the aspirator needle was withdrawn, and a finger passed into the opening—a large cavity could be felt. A good-sized drainage tube was inserted into the cavity, fixed, and the wound dressed in the usual manner. The patient stood the operation remarkably well, and remarked in the evening that he felt much better. The discharge came away freely, and the patient was doing well, taking plenty of nourishment.

On the evening of October 24th the temperature rose to 102°; the discharge, which was diminishing, was sweet and healthy, but I decided to wash the cavity out with warm boracic acid lotion. There was no change in the patient until October 29th, when he complained of severe headache, and his temperature had risen in the evening to 103°; this I could not understand, as the discharge from the abscess cavity was very slight, and consisted of blood and bile with a few threads of pus. As the pain in the head was so severe and general, I had his head shaved and ice bags applied; the temperature dropped in the morning, and the patient felt easier.

On the morning of October 31st I was sent for; the orderly on duty said that the patient had had a rigor. When I saw him he was unconscious, and there was rigidity of the muscles of the limbs. His pulse was hardly perceptible; he had passed his fæces involuntarily. I ordered a

hypodermic injection of strychnine, and half an ounce of brandy. In about half an hour he rallied, but remained in a drowsy and listless condition. I concluded that there was some cerebral mischief, but as the symptoms were so obscure, nothing definite could be diagnosed. He took a fair amount of nourishment by the mouth, but remained in the same drowsy state, and was becoming gradually weaker. The discharge from the abscess had almost diminished; his temperature now was subnormal. He had been gradually sinking and death took place on November 5th, 1903.

Post-mortem Appearances.—On opening up the abdominal and thoracic cavities, the liver was seen to be greatly enlarged—the left lobe reaching right over to the left side, and very congested. The liver weighed 73½ ozs. Adhesions had formed between the liver and the seventh and eighth ribs. A cavity was found in the upper part of the right lobe, which could hold nearly four ounces of water. On opening up the abscess cavity the walls were found to be well defined and formed of fibrous tissue. The cavity was empty except for a small quantity of thin dark red fluid. The remaining liver substance was otherwise healthy. The heart, kidneys, and spleen were healthy. The lungs normal, except for the bronchial tubes being slightly congested, which contained a small amount of mucus.

The brain was anæmic, and an abscess had formed in the right occipital lobe, situated about an inch and a half from the occipital protuberance. The abscess was not well defined; the brain substance had broken down at the surface, to the extent of about an inch and a half in diameter, and extended towards the lateral ventricles. The lateral ventricles were filled with pus of a pale green colour. The brain outside the abscess was healthy.

A CASE OF INGUINAL ANEURYSM; LIGATURE OF EXTERNAL ILIAC: CURE.

By Major M. P. HOLT.
Royal Army Medical Corps.

This case is reported for two reasons—viz., (1) the unusual cause ascribed, together with rapid development of the tumour; (2) the unexpected results of distal ligature, together with the reasoning which led to the performance of this in the first instance.

Driver M. B., aged 36, was transferred to Royal Infirmary, Dublin, on December 26th, 1903, with a note that he "reported ill on December 17th, 1903." "Excused duty for three days, and ordered to report again on December 21st, 1903." He stated that he first felt pain, and shortly afterwards noticed a swelling in the left groin after riding over a jump about December 3rd, 1903, thus giving a total history of less than three weeks' duration.

There was (on December 26th) a large swelling, presenting all the usual characteristics of aneurysm, reaching from 1 inch below to 2 inches above the left Poupart's ligament; immediately above the centre of the ligament there projected forwards, above the general level of the swelling, a small flattened cone, with apex size of a florin, where the coverings were extremely thin, and through which the finger could be easily pressed into the tumour; a very feeble pulse could be felt in the femoral below the aneurysm. It was decided to ligature, in the first instance, the common femoral only, for two reasons: (1) there would be considerable difficulty, from the short length available, owing to encroachment upwards of the tumour, in ligaturing the external iliac, and that, in any case, the ligature would be very close to the tumour; further, ligature of the common iliac is always comparatively very dangerous to the future circulation of the limb; (2) *proximal* ligature alone, wherever carried out, would probably fail to effect a cure, since the collateral circulation, by way of the deep epigastric, and to a lesser extent the deep circumflex iliac, would pass through the aneurysm and so prevent coagulation. It was thought likely that primary distal ligature might bring about considerable decrease in the tumour, and so facilitate the eventual success of proximal ligature.

On January 8th, 1904, the common femoral was tied, Kocher's incision was used, being more convenient, since the tumour reached considerably below Poupart's ligament; kangaroo tendon was used, the inner coats were not ruptured. The after progress was uneventful so far as the wound was concerned, but the aneurysm appeared to increase even more rapidly than before, and by pressure produced pains in the knee-joint, which gradually became more severe.

On January 18th and 19th it was necessary to give morphine hypodermically for the relief of pain in the knee, over the front of the thigh, and in the groin; there was hyperæsthesia on the outer side of the thigh. On the 19th these symptoms became so severe that the injection had to be repeated in order to prepare the skin for operation on the following day. The temperature rose on 18th and 19th to 101°, and he refused food. Meanwhile the circulation in the limb remained good and the foot warm.

On January 20th, 1904, the pain, &c., from pressure had become so severe that a hypodermic injection of morphine was necessary early in the morning, and again immediately before moving him from his bed. The cheeks had become hollow, and the facies one of extreme anxiety: he was constantly groaning and shouting. Ether was administered, and the abdomen opened by Lennander's method 1 inch internal to the semilunar line, the rectus was split near the mid line, the intestines were kept out of the way by the assistant holding the sigmoid flexure, the meso-sigmoid then acted as a fixed purdah beyond which the intestines could not pass. In exposing the artery very considerable trouble was caused by accidental rupture of the deep circumflex iliac vein very near its entrance into the external iliac; before, its appearance had been that of a fine band of fascia

stretched across the artery. It had been displaced upwards by the aneurysm for fully 2 inches, and considerable trouble was experienced in securing it deep down on the inner side of the tumour.

The remainder of the operation presented no difficulties; the trans-peritoneal route was used, a double ligature of kangaroo tendon was applied, and tied with a "stay knot," the internal coats were not ruptured, the abdominal wall was closed by layers, according to Lennander's directions. Before applying the dressing it was noted that pulsation in the tumour had ceased. The after progress was quite uneventful, the chief feature being the perfect relief from the very severe symptoms due to pressure on nerves before operation, and the general condition began to improve at once. The dressing was not disturbed till the seventh day, when the subcuticular stitch was withdrawn; the tumour had then already considerably decreased in size, was quite painless, but presented fluctuation on deep palpation. On March 6th, though he had been up fourteen days, there was still some deep fluctuation in the tumour, which was now of very small size, and quite devoid of pulsation; an exploring needle was pushed into it, and about an ounce of thick dark blood withdrawn. He was discharged from hospital on April 13th, 1904.

On May 12th he was sent up from his station in the country for inspection; he was then in robust health; the aneurysmal tumour was represented by a very small hard lump deep in the iliac fossa immediately above Poupart's ligament, without a trace of tenderness, evidently undergoing complete absorption.

It was remarkable that the aneurysm attained such dimensions within so short a period after the initial exciting cause, which apparently was a sudden grip of the saddle when his horse "pecked" going over a jump. There was a doubtful history of old specific disease. He is now married with a healthy family; probably the sudden instinctive muscular exertion which most people have experienced under similar circumstances often enough, caused a small lesion of the internal coats of the vessel which, in this instance, could hardly have been normal, and in this way the rapid increase may be accounted for.

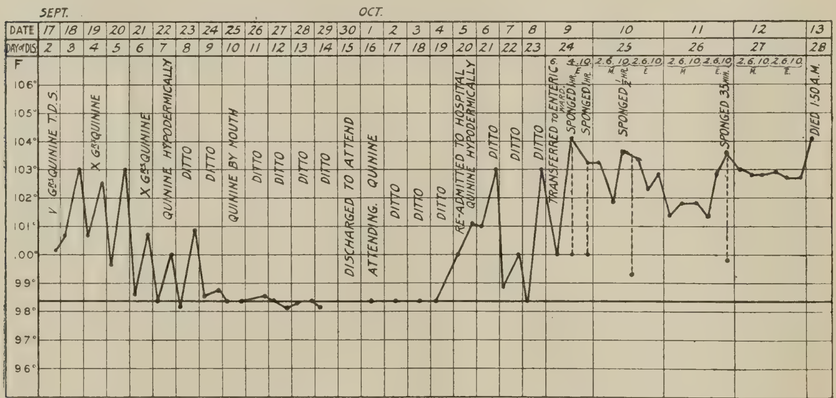
The aneurysm appeared to take on a new lease of life after the distal ligature, and thus presented a result totally different from that anticipated.

AN OBSCURE CASE OF AMBULATORY TYPHOID.

By Lieutenant-Colonel N. H. FORMAN,
and Captain R. SELBY.
Royal Army Medical Corps.

Private H., age 21, total service two years, nine months in India. Admitted to Station Hospital, Bangalore, September 17th, 1904. First felt unwell on September 16th. The appended chart in a great measure

explains the case. On admission, the symptoms were those of ordinary climatic fever, and yielded, after a week, to quinine. From 24th to 29th temperature was normal morning and evening, and he was discharged to attend on the 30th. He attended until October 5th, temperature remaining normal until that day, *i.e.*, he had a normal temperature for eleven days. Between October 1st and 4th temperature was only taken once daily, when he presented himself for inspection, and he always said that he felt well, tongue clean, &c.; in short, he appeared to be recovering from a mild attack of malaria. On re-admission, on October 5th, he was again treated with quinine in larger doses, and the fever reacted again to it. On the 8th complained of sore throat at the afternoon visit, and examination showed only slight congestion. He was lying in bed reading a book. On October 9th throat had become much worse, lung mischief, apathy, spleen palpable, discrete rose-coloured spots all over body, slight tympanitis; in fact, in twelve hours patient lapsed from a condition that was in no way alarming to one of profound typhoid prostration, *i.e.*, the condition characteristic of a malignant type of the disease far advanced. On October 10th, delirium. On October 11th and 12th, progressively worse. On October 13th, three hæmorrhages in rapid succession, 6, 30 and 8 ozs.; collapse and death.



Post mortem.—Both lungs congested, mesenteric glands enlarged, spleen 1 lb. 2 ozs. Typical enteric ulceration (about fifteen ulcers); one very large ulcer, 3 inches in diameter, at the ileo-cœliac valve, irregular and sloughing, tissues in neighbourhood much thickened. Evidently this was the source of the severe hæmorrhage. The remaining ulcers were small and, pathologically, about the end of the third week or later. Blood taken on October 11th gave Widal $\frac{1}{20}$, $\frac{1}{30}$, $\frac{1}{40}$. Two broth tubes inoculated from spleen gave growths.

Remarks.—The case appears to us to be unique, for by a fortuitous combination of circumstances he was under close medical supervision

throughout, a thing that must be very rare in so-called ambulatory cases. That the disease did not commence on October 5th is plain enough; then how are we to account for the antecedent eleven days of apyrexia, to say nothing of the original periodic character of the fever and its amenability to quinine? The accuracy of the observations can be vouched for, and we are therefore faced with the paradox of a case of enteric fever without any rise of temperature throughout a considerable portion of its course. It is much to be regretted that a blood smear was not taken in the first instance and before he was drenched with quinine, but the only microscope available at the time was out of order; possibly it would have shown mixed infection. Difficulties of diagnosis of enteric are familiar enough; this case seems to indicate that sometimes the diagnosis is impossible within the limits of present knowledge and methods.

There can be no doubt as to the diagnosis in this case, as the *post-mortem* examination revealed typical enteric ulcers.

Philosophy, Travel, &c.

THE ORIGIN OF LIFE.

I.

By Lieutenant-Colonel BRUCE SKINNER.
Royal Army Medical Corps.

It may, perhaps, be not uninteresting to attempt a sketch of the history of life on the earth, with a view to arriving at some idea as to its origin. To us whose life work is the study of man, the problem of his being must be one which cannot fail to be of interest. This problem is bound up with that of the earth on which he lives, and from which he, in common with all animal and vegetable life, obtains his food, and perhaps, indeed, acquired his origin.

The tyro learning to paint landscapes flies, like the scientist, to Nature for his models. Without entering into the methods of schools of painting, whether in Paris or Japan, Italy, Hindustan, or Glasgow, it may perhaps be conceded that the artist may study Nature directly without the intermediary of teachers. And by such means, "*nullius addictus jurare in verba magistri,*" artists have been known to become great. To learn to paint trees he sits before one or a group, and if of conscientious habits, he copies the subject down to its minutest detail. The result exhibits a tree with every detail scrupulously marked out, each leaf distinct, each ruga on the bark delineated. This principle, carried to its logical conclusion, would lead to the inclusion of the venation of the leaves in many cases. But on proceeding with the study of his art he finds that when his picture is hung on the wall, his hours of labour have been wasted so far as effect is concerned. He might as well have avoided detail, and kept to the broad effects of groups of leafage, light and shade: he would have saved time, and probably would have gained in effect, by judicious accentuation of points which, when on a large scale, naturally attract the sight, but which when transported to canvas, have a tendency, unless so accentuated, to become insufficiently significant in their proportions, thereby depriving the subject perhaps of the very emphasis which in the first instance led the painter to select his particular theme. The illustration of the distribution of leaves on trees requires a study in itself, the prosecu-

tion of which may lead to the neglect in time of the broad delineation of a landscape.

So in the elaboration of detail science works slowly. The subject matter involved is so vast, the ramification of details so multitudinous, the refinements of study necessitate such microscopic examination of each leaf and bud, each stone, crystal, insect, microbe and cell, that the workers have, of necessity, subdivided the labour. Each one travels along his own line. Each separate line involves a mass of intellect for its special study. Each discovery marks a step on along the particular branch to which it relates, but as it affects the whole vast world of research the step is a microscopic one. That discovery which, in the estimation of one branch of study, weighs like the step of an elephant on the stage of a theatre, is when measured in the balance of the knowable, but as the footfall of a fly on a universe.

How, in such a condition of humanly infinite requirements of knowledge, is it possible to obtain breadth in our picture? A breadth which will embrace the universe in a general scheme and form a picture portraying the general sum of what is known to-day. How can we do it? How can the man whose life is tied to elucidation of the embryology of the echinodermata leave his pursuit to investigate the derivation of sun-spots? How can he who is absorbed in contemplation of the solar chromosphere spare the time, or achieve the abstraction, requisite to plunge at the same moment into the study of the craniology of pre-historic man? The archæologist bringing to light the Minoan palaces of Crete, cannot track the giant sloth in South America.

On the other hand, what authority has any man who has not pursued any branch of investigation at least with distinction, to pose as the exponent of all? Who is he? What has he done? It may, indeed, be considered by some presumption on the part of the artist of science who, neglecting elaboration of the details which produce the materials of his picture, lays on with a broad brush the outlines, and attempts a painting in harmony with the knowledge of those whose life efforts have been directed to the study of the leaf and the insect, the water, the sunshine and the soil. Rash though he may seem to be, with humble heart he works, knowing that though, to his eye, it is the whole which appeals, to the eyes of many the details are as their life-blood, for deprived of the things in which their souls delight, their lives would become as bloodless as the lives of those who are physically deprived of their blood corpuscles.

Why seek for knowledge? Why, indeed! Except that the desire for it is inborn. The infant with wide-open eyes stares up at the sky, and kicks his still unstraightened legs and laughs with joy at the things he sees. The child just learning human expression asks at every turn, why is this or that? The youth asks fewer questions, for his life, if he is healthy, is full of action, but also because when he asks questions on subjects not contained in his books his masters cannot answer, so he saves his breath. The man ceases to question much, to hide his own ignorance. He asserts, and even persuades himself to faith in his own assertions. There are some, however, to whom the given answer is not satisfying. These want more; they see no finality, and know no limit. For knowledge to those in search of truth offers only stepping stones to things still unknown: yet those who know realise the limitations to what is known.

Is there any knowledge? If by knowledge is to be understood something finitely irrefutable there is no knowledge. There is no science existing to-day which may not be changed in its methods, its theories, its deductions, its data, to-morrow. Just as positively as men to-day say the world is round, men not so long ago asserted it was flat, while 2,000 years ago they taught that it was round. Geologists to-day teach that the continents of the present are composed of rocks which throughout the greater part of their extent were formed in water. In the same breath they say that the continents of to-day have always been the continents of the world. This inconsistency is the result of the swing of the pendulum from the days when changes of the earth's surface were attributed to cataclysms, to the period when all change became attributed to processes uniformly slow and gradual; and so great is the dread of the cataclysm that the professors cannot accept the possibility of such a vast change as that involved in the transformation of the seas of the past into the dry land of to-day, for fear they should have to fall back on the cataclysm to account for it.

Since this earth held collections of water as we understand and see it now, since the rivers ran into the sea with their burdens of mud, since the seas contained living things to build up banks and to form thousands of feet of deposit composed of their remains which fell into the ooze at the bottom, so long have the seas been filling up with deposit. "Yet the sea is not full." And for as long a time have coast-lines in one part been rising and in another falling; the mighty frame of this globe has been shaken by earthquakes; islands have disappeared, land and sea-bottom

have been flooded with lava; the earth's crust has been riven, the rifts have been filled with molten material from below; dust and ashes have risen into the sky to fall again at some place near or far from that whence they were ejected. What the land-surface loses the sea-bed gains. What the sea-bed loses of space for its water it compensates by robbery from the land. Therefore the sea is not full.

Where London now is was once a sea. Before that sea existed there was once land. This land in its turn was composed of rocks whose origin was in beds of water. Certainly twice has deep sea risen and fallen to the moon where our Metropolis now stands. There has been no rest. The life history of the earth is as that of man, with its ceaseless change.

To us children of the present the sinking of portions of our coast is but a passing incident, affording an occasional line which assists in filling the morning paper; or a leading article in an evening paper. The rising coast in another part attracts even less interest, as it appears unable to excite that remote consciousness of peril associated with an inroad of the water. As children we play on the sands of our sea-fringe like the fair-haired Greek children of Homer's time who "overthrew the sand on the sea-shore when amusing themselves"; and as children we do not see the constant creeping change ceaselessly happening around; but still, whether we think of it or not, the change goes on as it has always done, and where land is now, almost without exception, the sea once spread itself.

Not equally positively can we recognise the converse, for we cannot see the ultimate floor of the ocean; but inferentially we may suggest that where sea now is there were once extensive tracts of land. Perhaps taking the converse of the case of modern England, more than once there may have been land where the sea now is. And we, quarrying slates, making roads, digging coal, have cut through the old sea-beds and lake-beds, and out of them have collected the remains of once-living things; and have arranged and grouped the remains according to the order in which they succeeded each other in that long past history of change. In order to present a clear picture of the succession of the rocks to our minds, we have named the rocks with their fossils, so that we may recognise from the names how they stand in their relation to one another, and how they present in some parts a fairly consecutive history of the earth.

Then arises another question. Why should the rocks, widely distant from each other, which contain species of the same

character, be of the same age? For if the rocks have been named according as they contain certain fossils, it would be necessary to give the rocks of widely distant localities the same names. How can rocks antipodal to each other, containing fossils of similar classes, be of the same age, seeing that the fossils may have spread from one to the other? They must either be of different ages, or else similar species must have evolved simultaneously at different localities. In order to meet this objection it has been recognised that rocks, geographically distant from each other, but containing similar fossils, were not necessarily formed at the same time, and Huxley presented the world with the term "homotaxis" to explain that such a condition indicated the equal value from an evolutionary sense of these rocks. So that the nummulitics of Bagshot and of the Himalayas are homotaxial, as are the trilobites of Korea and Argentina, and the eozoa of Canada and Bohemia. This leaves the question of the actual age of rocks, similar as regards their life-forms, untouched.

How can we gauge that age? Language cannot convey an idea of the age, for the word age to mankind conveys an impression of relativeness to his own three score and ten. The average duration of life of man is some forty-four years at the present day in England. It may extend from a few moments only to as much as a few years over a hundred. So may the estimated age of the earth, when calculated at, say, a million to each year of the man, be correlated to the years of a lifetime. As the expectation of a man's life has been calculated, so has the probable duration of the earth's past. But as the man's life may exceed reasonable expectation, so may the past of the earth be beyond the computation—largely speculative, because built up on uncertain data—of the geologist, grudgingly followed at a lagging distance by the physicist. So when making efforts to arrive at the age of the earth the mind must free itself from chronology. Chronology can only be applied to historic man. To-day we can only approximately account for some six thousand years. Some tablets and inscriptions suggest placing "articulate man's" records a little further back. But this past is not clear as yet. If we give our records eight thousand years we seem to travel back into an abyss of time. Behind that there is as yet no possibility of chronology. A thousand years ago man was buying and selling, fighting and eating as now. Two thousand years ago he was doing the same; five thousand years ago the same. Perhaps ten thousand years ago also. But still his remains are among the superficial deposits of the earth's crust; he is a creature of

to-day in relation to the deposits forming that crust, thousands of feet of which have been actually exposed to his view. But as the bottoms of the great oceans are invisible, though we may consider it improbable that they contain remains of man older than those yet found on dry land, it would be incorrect to say that anything unseen does not contain the improbable or unexpected.

And if we found man lying beside the Iguanodon, or the Atlantosaurus, we should not be more astonished when it came to the touch, than when, as children, we absorbed the stories of "St. George and the Dragon," or of "Jason and the Golden Fleece." We should simply remark that it appeared as if the nursery stories of our infancy were but the remains of traditions of the infancy of man, the relics of the verbal relations of his struggles with the dragons of the prime. Though it has to be remembered that De Chaillu complained that the world did not believe him when he reported that he had found the pigmies of Homer and Herodotus.

The period of man's presence upon the earth is measured, so far as known at present, by the period during which the more recent earth deposits have taken place. Geological investigation, though by no means covering with any completeness the dry land of to-day, has so far only found human remains in deposits, which may perhaps extend back to the period classed as Pliocene; perhaps even as far back as Miocene (Thénay, Quatrefages) in Europe. Europe is the only continent approximately completely investigated as yet, and there man does not extend further back than deposits which are possibly Miocene. In California, Brazil, and Java, human remains have been found in recent deposits, solitary fossil specimens in each of those countries. But the workers have been few and the world is large.

The history of man then is incomplete. But his history is not more incomplete than that of most animals. Throughout the range of fossil remains of all kinds, rock-beds are found containing large accumulations of different species of living things exhibiting well-developed forms, but practically no gradations. These remains are found in beds, and there exhibit in each bed an assembly of well-marked forms of one variety of the species they represent. Each variety bears traces of evolution from an ancestor common to some other varieties, but they have evidently not undergone their evolutionary changes in the localities where found—they are established varieties.

This does not indicate that they were not evolved from pre-existent varieties and species. It only indicates that we are dealing

with deposits containing ready-made varieties and species. The doctrine of the evolution of species, theoretically sound, and borne out by one or two well-marked instances of graduated variation, as in the case of the horse, is as yet not illustrated by actual demonstration as applied to palæontological remains generally. The reason may be that we have not yet found the deposits indicating the locality whence the successive established species spread over the earth.

A TRIP TO THE ANTIPODES, 1903.

By Colonel J. M. BEAMISH.
Royal Army Medical Corps.

A good train service between the central parts of Northern India and Calcutta, and thence by the East Coast railway, in sight of sufficiently varied and interesting scenery, comprised in: (*a*) windings at the base of wooded hills, round Chilka lagoon, south of Cuttack; (*b*) passage through a cleft in a spur of the Eastern Ghâts which gives exit to the Nagadali river, near Chicacole, and (*c*) spanning, successively, the three great rivers—Madanuddi, Godavery and Kistna—which flow eastward into the Bay of Bengal, brings the traveller to Madras in the space of three days; and two days' journey onward, by the South Indian Railway, through Trichinopoly and Madura, ending in a short sea-voyage of twelve to fourteen hours, between Tuticorin and Colombo, places him in communication with either of the two principal lines of steamers (Orient or P. and O.), sailing weekly for Australian ports.

Two days from Colombo, the line is crossed *en route* to Freemantle, which is usually reached on the tenth day after leaving Colombo, and traversing a distance of nearly 3,000 miles out of sight of land. Numerous suburban trains between the port of Freemantle and the city of Perth—some twenty miles distant—afford the visitor an opportunity, during stay of the ship in port, of seeing the progressive capital of Western Australia.

Perth has an interesting history, having been one of the earliest convict settlements. All vestiges of such occupation have now, however, almost entirely disappeared, and given place, within comparatively few years, to a handsome modern city, with regular streets, electric tramway, well-appointed shops, public buildings and parks. A piece of ornamental water—an expansion of the Swan River—also tends much to the attractiveness of the city, and is

largely availed of for recreation purposes, such as boating and location of boat-houses during the hot months of the year.

Perth is estimated to contain a population of nearly 40,000; and from a few thousands of inhabitants, has grown to its present importance in the short space of twelve years. This fact is explained by its proximity to the recently developed gold mines at Coolgardie and Kalgoorlie, distant from Perth about 300 miles, now linked by a railway. The gold fields already share the enterprise of Perth, in the growth of towns and municipal institutions, and have recently been provided with a water supply of undoubted purity, conducted by mains the whole way from Perth, at a cost of three millions sterling. A government mint, in connection with the gold industry, is now established at Perth, whence there is a large export of specie.

Although the interior of Western Australia, like that of the Continent generally, is barren and subject to drought, a strip of land along the south-west coast, more favoured by rain, is forest-clad, and the jarrah wood (used for street paving) industry, in this direction, is assuming large proportions.

Returning to our ship we pursue a southerly course, round Cape Leowin, the south-west point of Australia, and passing within sight of St. George's Sound, at Albany, cross the great Australian Bight, to anchor at Adelaide on the fourth day from Freemantle. Lateness of arrival, 4 p.m. in winter (July 27th), and unsettled weather, added to a considerable distance from the shore, encourage but few to land, and bring those who do so back to ship in a drizzle, late at night. The land view is pleasing, Mount Lofty furnishing a striking background to the city of Adelaide, picturesquely set amid its parks and gardens.

Two days from Adelaide land us at Melbourne (29th July) for a day, during which it is possible to inspect its city and public buildings of chief interest—Art Gallery, Museum and Houses of Parliament.

Next day we resume our course southward through the Ripp—entrance to Port Phillip—passing the sea-side resorts of Sorrento and Queencliff on either side; and veering eastward through Bass Strait enter the Pacific (Tasman Sea), whence the route north-east is open to Sydney, two days from Melbourne.

On arrival at Sidney, you will probably not be asked "have you seen our harbour?" Nevertheless, this question has an inner significance, scarcely ever realised. It is not, for instance, generally known that the mileage in and out of the numerous bays and inlets

which are comprised in the harbour, gives a total of 1,200 miles, in other words, covers the distance between Melbourne and Bluff (New Zealand) ; but apart from such a huge configuration of its harbour, Sydney itself has much more of an old-world appearance than any other of the Australasian cities. The Georgian style is much in evidence in the older buildings, and the very irregularity of its streets, departing from the newer rectangular plan, which obtains elsewhere, reminds one forcibly of the Mother Country. It is said that George Street, the principal thoroughfare of Sydney, in its somewhat devious course of a mile or more, owes its origin to a sheep walk. The art gallery and museum are well worth a visit, the former containing some originals, or copies, of pictures by the old masters, as well as many others of more modern date, and the latter comprising a very fine collection of birds, indigenous, and others largely derived from the Pacific Islands, as well as several interesting relics of Captain Cook, the celebrated founder of the colony.

The botanic gardens are a just source of pride to Sydney, beautiful in surroundings and situation, abutting in horse-shoe form on Farm Cove, at the south side of the harbour. St. Andrew's Cathedral (Church of England), though small in size, is an ornate building in the Gothic style, with western towers. It occupies a site fronting George Street, much inferior to that of St. Mary's (Roman Catholic), still unfinished, on high ground overlooking Hyde Park. The same remark applies to the relative situations of St. Paul's (Church of England) Cathedral, Melbourne, on a low confined site at the corner of two streets, and the Roman Catholic Cathedral, St. Patrick's, a magnificent structure, occupying a commanding site on a hill near the Houses of Parliament. The older sites, were, however, probably determined by necessities of original occupation.

The Civil Hospital is an imposing building, occupying a choice site on high ground overlooking Macquarie Street, and the Domain, relatively better placed, as regards open space, than the similar institution at Melbourne.

A hasty glance at some of the objects of interest in Sydney, as above outlined, leaves time for a week-end excursion by rail to Mount Victoria, seventy-seven miles distant S.W., and 3,424 feet above sea level. The route lies over the Blue Mountains, covered with natural forest—chiefly consisting of varieties of the all-pervading eucalyptus—except at cleared settlements, a few miles apart, which are the country houses of city men seeking change from the, at times, oppressive heat of Sydney. The weather now (August

2nd), however, does not favour an excursion previously arranged for, and the dream of a drive to Katoomba Falls and Govett's Leap, ends in the stern reality of a snow storm, and a comforting log fire within the wooden walls of an hotel at Mount Victoria. *Facilis descensus* to Sydney next day, another look at the city, including the observatory on Flagstaff Hill, and a well-rendered performance of Shakespeare's "Midsummer Night's Dream," at one of the principal theatres, and a passage is booked in the Union Co. s.s. "Taluna," sailing August 5th for New Zealand.

Auckland, the former capital (population 67,000), and now the chief centre of the Kauri gum industry, is reached on the evening of the fifth day (August 9th), in fair weather, earlier in steamers of more modern type belonging to the same Company. Quarantine is strict, and the passengers get passports next day to disembark and proceed to the interior, reporting themselves to the health authorities *en route*.

The busy streets—Queen Street being the most imposing—are inspected ; the museum, containing the best collection of Maori relics extant, library and art gallery, are visited ; also, on the introduction of a shipmate, opportunity is afforded of seeing a unique gallery of portraits (private collection) by a European artist, of Maori Chiefs in native costume, many of whom fought against us in the New Zealand War (1860-65), and most of whom have since died. A short ride on a tram-car, ending in the ascent on foot of Mount Eden (640 feet), the crater of an extinct volcano, commanding an extensive view of the suburbs and harbour, completes the survey of Auckland, so far as time permits, and next morning (August 11th) the train starts for Rotorna, 171 miles S.E., the centre of the Hot Lakes district, and now an established health resort, well provided with hotels and a spa, situated in attractive grounds.

A day is spent on the lake at Rotorna, taking in sights adjacent, viz., springs at Hamurana, mud volcanoes and boiling springs at Tikitere; another day at similar sights near Whakerewarewa and a third (over night) at the famcus Waimangu Geyser, reached by an eighteen-mile drive from Rotorna, and ejecting *débris* of stones, mud and hot water mixed with steam periodically, every thirty-six hours, to a height varying from 800 to 1,500 feet, a sight probably unique of its kind in the world, and which the writer was fortunate enough to witness. The crater basin, full of black muddy water, after subsidence of the eruption, measures 317 by 182 feet, and has recently—the week of the writer's visit—been crossed in a boat,

at imminent risk to the occupants, during an interval of eruption. Three weeks later, August 30th, an accident occurred, resulting in the loss of two lives, ladies, detached from their party, and engaged in photography near the edge of the high bank (200 feet) overlooking the crater, when they were surprised by a sudden eruption and swept away in the boiling flood, their bodies being recovered a short time afterwards, in a mutilated condition, some distance down a gorge emerging from the crater. Eggs are cooked in the boiling overflow water which collects in pools in the neighbourhood of the Geyser. A rest-house, not open at the time of the writer's visit, has now been erected at a convenient and safe distance on a neighbouring hill, accommodation meanwhile being roughly provided in tents by a caterer. Wooden shelters are also provided at short distances from the brow of the crater.

The round trip to Rotorna is continued from Waimangu by a Government boat service, for parties of not less than four, across Lakes Rotomahana and Tarawera, the intervening ground, limited to three or four miles, being crossed on foot, and the journey completed by coach, *viâ* Wairoa to Rotorna. It is usual to spend a night at Waimangu in the way described, but should the Geyser be in a complacent mood, it is possible to complete the whole round from Rotorna in a single day.

From the portion of Rotomahana, skirted by the boat, are seen the usual boiling geysers and steam holes on the hill close by, and the water of the lake can be felt quite hot. At one point is shown the site of the celebrated pink and white terraces, now submerged, in consequence of the Tarawera eruptions in the vicinity eighteen years ago. The effects of this wonderful phenomena are seen to this day, and will probably appear, to a great extent, for all time, in the desolate appearance of the country over many square miles from the centre of eruptions—Tarawera Mountain—in the annihilation of whole villages, and in the altered level of the adjacent lakes. The whole district has the appearance of an inferno, and is said to be worth tons of sermons in promoting to good resolutions. The Tarawera district has, however, one redeeming feature, in that it supports Wild Pig, which afford sport and amusement to lovers of the chase.

From Rotorna, where the railway is left, the route chosen lay through the centre of the north islands, first to Wairakei, *viâ* Waiotapu Valley, fifty miles, thence to Lake Taupo, six miles by coach, across Lake Taupo, twenty-five miles in a launch; thence from Tokanau on the south shore over a high table land covered

with pumice or the universal ti-tree (*manuka*), favouring barren localities, to Waiouru, forty-four miles; thence a descent of forty-four miles to Pipiriki on the Wanganni River, where steamer accommodation is reached. The hotels are good at the beginning and end of the route, but the intermediate ones are, as may be expected, less sumptuously provided, in such a remote and desolate region.

On this coach drive of 150 miles north and south of Lake Taupo, the centre of the route, the chief points of interest are, first, at Wairakei, fifty miles, where the Arateatea rapids, on the Waikato River, and the Geyser Valley, abounding in hot springs and steam holes, are visible, the latter the same in character as those at Rotorna. The Waikato, at this point, has a rapid current, emerging from Lake Taupo, and pursuing a north west course of about 200 miles, reaching the sea some distance south of Auckland. It flows in a deep stream between confined banks above and below the rapids in its course, and has long been a favourite resort for the angler. The rivers of New Zealand have been largely stocked with imported fish, and the writer was informed that trout of an American variety were the most successful in their new *habitat*, salmon not doing so well as might be expected.

The next point of interest in this central route through the north island presents itself in a magnificent series of volcanic mountains—Tongariro, Nganruhoe and Ruapehu (6,000 to 9,000 feet)—which burst upon the view from the high ground overlooking Lake Taupo on the north side. This is the finest panorama obtainable of the group, including the active crater of Nganruhoe, inasmuch as the nearer view from the south side of the lake where the road skirts their base, is attended with loss of effect due to partial, or even complete, exclusion from view of the two further cones, visible simultaneously at the greater distance. From the north side of the lake the combined view of the series with their snow-covered sides, Taupo in the foreground and Nganruhoa in eruption, leaves an impression never to be effaced, and recalls by their juxtaposition, to compare smaller objects with great, the triad of Monck, Eiger and Jungfrau of the Bernese Alps. Distance, in the present case, lends more than enchantment to the view.

Before taking leave of Lake Taupo I may refer to an interesting relic of our military occupation, 1860-65, in the form of an earth-work entrenchment, near the north shore of the lake, which is still in a good state of preservation. There is also a Spa at Taupo itself, in the immediate neighbourhood of the lake.

Folk lore is not wanting in the legends of Taupo, and an island in the middle of the lake is fabled to be the truncated cone of the headless Tongariro on the south side, which it certainly resembles, the head having been detached during a quondam encounter between the giant mountains, and thrown into the lake, where it finds an abiding place.

Transporting ourselves in thought across lake Taupo (twenty-five miles) to Tokanan, where there is an hotel, the ascent is continued to Waiouru (over 3,000 feet), through country of no special interest in itself, apart from its surroundings. The latter comprise, in the west, the volcanic range above described, and in the east at some distance, a bold chain of forest clad mountains (Kaimarawa and Te Whaiti ranges), which are said to contain deer, the latter imported. No wild animals of the tiger species exist in New Zealand. In fact no four-footed beast is indigenous to the country, except a native rat, and even so much is doubtful. This absence of animal life, and the existence merely of birds—like the extinct moa and apteryx, which from helplessness, fell an easy prey to their captors—furnish some palliation for cannibalism, which was universally practised prior to our occupation.

The country itself at this point of our route is barren and uninteresting, completely covered with pumice or black ash from the adjacent volcano (Nganruhoe), not capable of cultivation and merely growing the ubiquitous ti-shrub, and this in stunted form.

Waiouru, forty-four miles from Tokanan, is eventually reached in a blinding snow-storm (August 17th), and from thence a descent is made next day to Pipiriki (forty-four miles also) for a great part of the journey through the same desolate country, by an indifferent road, and finally through bush which is being gradually cleared, to admit of cultivation.

The approach to Pipiriki lies through some exquisite bush scenery, tree-ferns mingling with plants of larger growth along the ravines, till the Wanganni River is reached at Pipiriki itself, navigable thence for steamers of light draught, sixty miles to the sea and appropriately here styled the Rhine of New Zealand.

It is at this point that one comes in contact with the greatest numbers of the aboriginal Maori race, now a vanishing quantity. Like Pacific islanders generally, their destiny seems to be extinction, after permanent association with European races. Various causes are assigned for this, such as spread of certain diseases, phthisis, &c. and the abuse of alcoholic liquors; but it is also probable that an entire change in their mode of life, with absence of the stimulus of

independent action and rivalry between the tribes, as they once existed, have also had their share in the decline of this interesting race. Tradition, going back 600 years, points to their original migration from Haawaki (Hawaii ?) in the Sandwich Islands, across 60° of latitude. The incredibility of such a remote origin has brought Rarotonga in the Hervey group, a third of the distance, into favour as the home of the race ; but there is nothing inherently improbable in both sources of migration at different times, from the history of castaways who are known to have drifted at least 1,500 miles with currents, and the Pacific Islands also naturally favour such distant migration. To whatever source they may be traced, they evidently belong to the brown straight-haired Polynesian race, contrasting strongly with the Negritos or curly-headed Papuans.

The Maoris, though somewhat indolent, are a light-hearted sociable people, with an aptitude for music and singing, and naturally take to skilled musical training in bands, &c. A grace, amounting to courtliness, was also observed in their everyday greetings, which was most conspicuous in the behaviour of a host, on one occasion, to his guests. They live on the best of terms with their European fellow countrymen, who, as far as could be observed, are even proud of their Maoris. Comparisons are made between the Maoris and Australian aborigines, much, and justly so, to the disadvantage of the latter. The time seems remote when an Australian bushman may be supposed capable of taking part in the government and public offices of his country, as the Maori now does in New Zealand.

Wanganni, situated near the mouth of the river of the same name, is a rising town of some 10,000 inhabitants, on the high road of commerce and travel. It is connected with Wellington, the present capital of New Zealand, by rail, distance 150 miles, covered in eight or nine hours.

Wellington, with a population of nearly 50,000, has recently become a place of importance as the seat of Government, and also as a port. The harbour is protected by a range of hills in the form of an amphitheatre, which, however, leaves little or no room for expansion of the city without occupying the heights. As a matter of fact the principal warehouses and public buildings are constructed on artificially made ground, rescued from the sea, near the foreshore. There are several hotels, a museum and club, in addition to the Governor's residence and Houses of Parliament. A night on a coasting steamer from Wellington brings one to Lyttelton (Port of Christchurch) next morning, and the journey is continued a short

distance by rail, through a tunnel, to Christchurch. A cursory look at the Cathedral and principal streets (museum not open), reveals the fact that it is an English settlement, and the journey onward to Dunedin by a comfortable day train, at once in sight of the sea and the snowy range of the New Zealand Alps, lies through Canterbury, which may fairly claim to be considered the garden of New Zealand, though parts of Taraneki and elsewhere in the North Island, and Invercargill in the South, may dispute this supremacy.

Dunedin, a Scotch settlement, population 52,000, busy with commercial activity, and picturesquely situated among hills a few miles from its port (Chalmers), has some good hotels and streets, and is, through its shipping, *en rapport* with the civilised world. The museum contains an interesting restoration of the extinct moa, remarkable for the huge size of its leg bones, and apparently cased in the feathers of an emu, to which, as well as to the cassowary and ostrich, except for its much larger size, it bears a great resemblance.

An important industry in the Southern Province (Otago) is gold-dredging, of which the writer had an opportunity of seeing the method adopted at one of the works near Gori, in the centre of the province. A claim is selected, usually in an old river bed, and the gravelly deposit was, in this instance, lifted by revolving buckets, worked by an engine. The deposit was collected, washed and treated with quicksilver, for the purpose of extracting the precious metal. The writer was informed that the output was about 25 or 30 ozs. a week—value £4 an ounce—and that the working expenses were covered by 8 ounces, thus leaving a considerable margin of profit, allowance being made for deterioration of plant. Simple contrivances of this kind, however, are replaced elsewhere in the province—Cromwell district, for example—by more expensive plant, requiring a larger output to cover expenses of working, and involving greater risk, with, perhaps, less net profit.

The frozen meat and wool industries need only just be mentioned.

Lake Wakatipu, the centre of the famous glacial district of Otago, is reached in a few hours by rail from Gori Junction. It is sixty miles long from Kingston, where the steamer starts from, to the head of the lake near Glenorchy, one to three miles wide, and 1,400 feet deep. It has an S-shaped bend about half-way, where Queenstown is situated, the latter provided with good hotels and a convenient centre for exploring the locality. At the time of the writer's visit, last week in August, snow covered the bare mountain sides almost to the edge of the lake, and the peaks of Mount Earns-

law (9,000 feet) near the head of the lake; Ben Lomond above Queenstown, and the Remarkables, a serrated chain on the east side near Kingston, offers tempting inducements to the Alpine tourist.

Queenstown, besides the natural beauty which it possesses, is an ideal sanatorium, the air being pure and dry, with bright sunshine at all seasons of the year. Roads are being extended and a park laid out for the benefit of visitors. An arm of the lake at its eastern extremity, about four miles from Queenstown, is the source of the river Clutha, which enters the sea some distance south-east of Dunedin.

A day's run—three hours by steamer to Kingston, and thence by rail through the Waimea Plain, Gori and Invercargill to Bluff—brought a delightful tour of three weeks through New Zealand to an end, late on August 31st, in time to embark on the twin screw Union Line s.s. " Moeraki " for Melbourne.

The title of this paper is sufficiently justified by the observation that just outside Bluff, the most southerly point of New Zealand, the course lies within a few hundred miles, say a day's voyage, of Antipodes Island, not far also from the 180th degree of east longitude, or half way round the world. Further, the turning point is here taken on the homeward journey in the direction of Melbourne (1,200 miles). Hobart is temporarily excluded from the route on account of quarantine, due to small-pox, but the coast of Tasmania is sighted in three days, and the remainder of the voyage completed to Melbourne well within the fourth day.

A more extended survey of the city and suburbs than was possible on the outward journey is now undertaken, in the company of a friend, who also arranged a programme, to be completed within ten days, and embracing such opposite directions as Gippsland, eighty miles east, and the mining cities of Bendigo and Ballarat, 100 miles north and north-west of Melbourne.

The Mayor of Bendigo is requisitioned for a passport which, through the town clerk, he courteously provides, and one of the principal mines near that city is inspected by a shaft provided with a lift and leading to galleries some 1,000 feet below the surface, which shows the precious metal imbedded in quartz reefs. We are finally entertained by his worship, the Mayor, the same evening, at a " smoking-social " in the Town Hall.

At Ballarat (100 miles), on the same circular tour from Melbourne, we spent a few hours in visiting the ornamental lake, where there is a boat club and gardens, but, through limited time, were unable to make use of hospitality open to us, through the introduction of a member of the Melbourne Stock Exchange.

The trip of Gippsland is made by rail—seventy-five miles—as far as the terminus of Neerim South, whence a short drive of eight miles brings us face to face with a fine range of mountains, well wooded, and swept by a refreshing breeze. Gippsland is here essentially a highland country, undergoing gradual reclamation of the primæval forest, but requiring far more hands than are available for such slow and laborious work. The process consists in setting fire to the trunks of the great trees, 200 to 300 feet high, with corresponding girth, when, after some weathering, they are removed and the ground cleared. While in this decaying stage trees are a source of danger, from their liability to fall on cattle, or other accidents. Bush fires, aided by high winds, sometimes produce great havoc, wrecking homesteads, and destroying property in an incredibly short space of time. These fire-stricken forests give a peculiarly weird appearance to the landscape. When clearing is postponed grass seeds are sown between the decayed trunks and the ground thus utilised for sheep pastures. When finally cleared, however, the farms, in the more accessible localities, have an appearance of great neatness and fertility.

Mid-September again calls to mind the return journey to India from Melbourne, which is followed in reverse order by Adelaide, Freemantle, and Colombo, where, on the outward journey, it may be remarked, time was found over night for a flying visit to Kandy. The British India Coasting Steamer awaits the arrival of the "Orient" at Colombo in the early afternoon of October 1st, and passage is at once taken to Tuticorin, the journey being continued to Upper India by the South Indian Railway to Madras, and thence by the East Coast Railway to Calcutta as before; *en route* the sights at Madura were inspected.

As we were about to leave Freemantle for Colombo on the return journey (September 21st), two stowaways (whites) were discovered terribly mutilated through having become entangled in the chain connected with the steering gear in the hold of the ship, where they had taken refuge. The injuries consisted, in the case of one man, of an extensive lacerated wound in the right groin, almost severing the limb from the trunk, which resulted in death from shock and hæmorrhage within a short time; in the other case, of a fractured thigh and leg—the man having been removed with his dead companion in a tender just as the ship was leaving. The injuries received every possible attention from the ship's surgeon.

Climatology.—The change was, at first, rather abrupt, between the great heat of Upper India early in July, and the comparatively

low temperature of the South Coast of Australia up to the time of arrival at Melbourne—29th of the same month. At high elevations also, on the Blue Mountains near Sydney, and on the Central Plateau of the north island of New Zealand snow fell heavily, but at no other place was the cold intense, or beyond endurance of a person in ordinary health, provided with clothing suitable to variations of temperature. Even in the most southerly province of Otago, where the climate most resembles that of our own country, the cold in the latter part of August (a few weeks previously, however, much more severe), was that of early spring, with a remarkable prevalence of clear bright weather in the lake district bordering on the Southern Alps. Rain fell on a few occasions only, twice at sea off the Australian Coast, and in the Indian Ocean two days from Colombo, and once heavily at Rotorna (Hot Lakes) New Zealand, on August 14th.

We encountered nothing deserving the name of a storm, though we met a partially disabled ship on the return voyage off the South Coast of Australia, which was caught in a gale immediately in front of us. We also had a squall off Bluff (South of New Zealand) on the night of sailing, but next day encountered fine weather, which accompanied us to Melbourne. The sea, too, was rough as Colombo was approached, the last two days of September. The passage between Sydney and Auckland, early in August, was remarkably fine, exceptionally so, I am inclined to believe. I regret I was unable to keep a record of meteorological observations.

Roads and Conveyances.—The roads of New Zealand are good in the neighbourhood of towns and about the older settlements, and even where not yet properly metalled, are laid out on good lines; but in the more remote districts they tend to degenerate into mere tracks, beset in places, under certain conditions of soil and weather, with sloughs, ruts or deep mud, rendering them almost impassable, and requiring the greatest driving skill, and a special construction of coach to prevent accident. This description applies especially to the road for a distance of some miles approaching Pipiriki, north island of New Zealand from the north; even here, however, a beginning has been made of scientific metalling. The horses are willing, as a rule, well-fed and highly trained, but their expenditure is said to be considerable, owing to the severe and continuous work which they are required to perform.

The conveyances are either the usual four-in-hand stage coach, or a lighter carriage drawn by two or three horses, with coupé and capacious driver's seat. It may be added that the New Zealand Government, aided by private enterprise, is quite alive to the importance of developing the tourist traffic of the country.

Social and Political.—There is an appearance of sturdy activity throughout the Australasian Colonies, and, if wages are high, work is unremitting during hours of labour; but few weaklings are in evidence, and the colonists generally are good specimens of the manhood of the race.

Opinion, as is well known, is divided on the labour question, and the advantages or otherwise of importing coloured labour. It is waged, on the one hand, on behalf of a white Australia, that experience of the introduction of Chinese labour in the past is not encouraging, the half-breeds resulting being degenerate specimens of humanity; while, on the other, it is beyond dispute that the whole population is not increasing rapidly enough, even with the aid of machinery, to cope with the enormous amount of work left to be done in developing the resources of the country. At present there is a dead-lock, with artificial crowding into the large towns and mining centres, to the detriment of agriculture in its various branches, upon which the staple industry of the country should depend, *qui sa*, when and how the dead-lock will end.

Details and Cost of Trip.—I have, in the foregoing pages, given a sketch with impressions of a ninety days' return trip (July to October, 1903), between India and Australia, covering a distance not far short of 18,000 miles by sea and land, the time being about equally divided between both, or an average of 200 miles per day. I may add that the trip was undertaken with very particular attention to dates of sailing, and little or no margins left for accidents, so as to bring it within the specified time of ninety days. For this exactitude in arranging dates I am much indebted to the advice of Messrs. T. Cook and Son, Tourist Agents, Calcutta Branch.

The cost of a return ticket between Calcutta and Sydney by the route taken and Orient steamers, may be set down as the equivalent of £90, including food, without extras on board ship. The hotels are usually well found throughout the colonies, and well adapted for tourists—inclusive charges about 12s. 6d. a day without liquors. A round trip through New Zealand from Sydney to Melbourne, or *vice versâ*, may be secured for from £30 to £50, according to the route chosen. Hotel bills are not included in this estimate.

Coupons may be had of Messrs. Cook and Son, and are accepted at most hotels. Their circular notes are also a convenient and safe method of carrying money.

TRAJECTORY OF SMALL BORE RIFLES.

As many discussions are held concerning the flatness of the trajectory of small bore rifles, and as much difference of opinion seems to exist, we addressed two questions to an authority on the subject.

(1) If I aim at centre of bull's eye at 500 yards' range, with the 100 yards sight up, how far will the bullet fall below centre of the bull's eye

If using 100 yards' sight the bullet will strike 12·65 feet below centre of the bull's eye. If using no elevation at all the bullet will strike 14·49 feet below the centre of bull's eye.

(2) If I fired at a target 500 yards away, using the sight for 100 yards, what distance would I require to aim at, above the bull's eye, in order to hit the bull's eye?

(i.) The angle of elevation for 100 yards' sight is 4·43 minutes; therefore the point at which the barrel *axis* is aimed is 5 by 4·43 inches = 22·15 inches above the centre of the bull's eye at 500 yards (since one minute of elevation gives 1 inch at 100 yards, 2 inches at 200 yards—and 5 inches at 500 yards).

(ii.) Time of flight for 500 yards is ·95 second; in this time a bullet will fall (from formula $S = \frac{1}{2} gt_2$) $\frac{1}{2}$ 32·2 by $\cdot 95_2$ = 14·49 feet. But the barrel, owing to the elevation for 100 yards, is already aimed 22·15 inches = 1·84 feet above the bull's eye; therefore to hit centre of bull's eye aim 14·49—1·84 = 12·65 feet above the centre of bull's eye when using the 100 yards' sight for firing at a bull's eye at 500 yards.

N. B.—The whole of the truth of the above depends: (*a*) upon the angle of elevation for 100 yards actually being 4·43 minutes; (*b*) upon the time of flight for 500 yards being ·95 second.

I will not vouch for either as I take them direct from tables.

Abstract.

A SIMPLE METHOD OF DISPOSAL OF CAMP REFUSE.

By Captain L. W. HARRISON.
Royal Army Medical Corps.

During the South African War there were very many camps used as halting places for convoys and movable columns, where the sanitary staff available for dealing with the large amount of resultant refuse was very limited. Captain L. W. Harrison, R.A.M.C., devised a very simple means of effectually disposing of this material, which seems worthy of more extended application. On field service there is always an immense quantity of empty tins of all sorts and sizes; these should be collected together and stacked in a number of little heaps about four feet high; upon these heaps should be piled the miscellaneous combustible rubbish, and the heap then set alight. The tins serve the purpose of keeping a good air space between the ground and the rubbish, and so cause the whole heap to burn with a fierce draught, all the combustible material being reduced to white ashes in about four hours. The burnt tins can be used again. This plan takes much less time and labour than would be required to dig trenches and bury the rubbish; moreover it does not pollute the ground. Even in wet weather the plan may be carried out, though of course not so expeditiously.

REPORT OF THE ROYAL COMMISSION ON THE WAR IN SOUTH AFRICA.

As the actual volumes of this important report are unlikely to be accessible to the majority of members of our Corps, while the evidence contained in their pages cannot fail to be of interest to our readers, we propose giving a *précis* of the evidence so far as it relates to medical organisation before and during the late campaign. For this summary, which is continued from p. 701, vol. iii., we are indebted to Lieutenant-Colonel Edwin Fairland. It deals mainly with evidence regarding medical equipment.

The Right Hon. St. John Brodrick, M.P., called and examined :—

(Q. 21,757.) You have also, in the way of decentralisation, introduced an Advisory Board into the Medical Department, have you not? I think its introduction has been a great advantage. . . . You have the great Medical Schools all over the country, and up to quite recently our Medical Department has kept quite aloof from them. It is obvious that you want to interest, if you can, the heads of the great civilian Medical Schools in our Medical Service. We want to get the facilities that they give for study for our medical officers. By instituting an Advisory Board, on which some of the most eminent men in the profession are giving almost gratuitous work, we have obtained touch and sympathy which, so far as it has gone, has been productive of the very best results. I think the head of the Army Department should be the Chairman of the Board, and I certainly have received from the medical people every encouragement to persevere in this system.

(Q. 21,758.) We have had evidence from one member of the Advisory Board that one immediate result was the discovery that the Military Hospitals in this country were very inadequately equipped? I think modern science has progressed extraordinarily quickly with regard to hospitals generally, and we have fallen behind as compared with civil hospitals. For instance, say, Guy's Hospital. You would not have found it ten years ago in anything like the condition it is now. We have undoubtedly fallen behind, and some of our hospitals want modernising badly. On the new Advisory Board, I cannot thank them sufficiently for it; these surgeons, who are earning enormous fees in the morning's work, have given up many days in the last year to go round and report on our Military Hospitals; and in order to deal promptly with many of the questions, I formed a small Committee of their Board, with a Military Medical Officer on it as well, and have given them the administration of the money we have voted for such improvements, in order that they might promptly apply the remedy; and I have no doubt we shall get the whole benefit of the most modern medical improvements of science.

(Q. 21,759.) But it is a very large work we were told—it will cost a good deal of money? It is a very considerable work; it is astonishing what a number of matters have changed completely, apparently in the last four years. We can only go gradually to work. The construction of a hospital like Netley, which is a very fine building, would render it impossible, even if you had the amplest funds, to make the change. It must be progressive. Since the Advisory Board was started our medical arrangements have progressed 40 or 50 per cent.

(Q. 21,761.) You consider that these changes in their result will be worth all the money that will be spent upon them? Yes, I think so. But, on the other hand, I am afraid I must say that there is no department which would find it easier to spend a very large sum of money in getting perfection.

Lieutenant-General Sir Ian Hamilton, K.C.B., D.S.O., gave his estimation of the Medical Service in the following report:—

"I think these proved equal to all demands which were made upon them, except during the epidemic of enteric at Bloemfontein. But it seems to me that no nation could afford to supplement its military forces by a medical organisation capable of coping simultaneously with the normal results of a campaign plus a violent epidemic of sickness. The Army Medical Service is animated by a very high standard of duty. Nothing could surpass the devotion either of the doctors or the nursing sisters with whom I came in contact. As the war went on they became more and more popular with officers and men. The specially-enrolled doctors were also admirable. There is one point, and one point only, on which I would discriminate between the R.A.M.C. and those doctors who came either from over-sea Colonies or who were recruited in South Africa itself. The latter seemed more free from red-tape and less afraid of incurring responsibility, especially when a point had to be stretched regarding regulations, or where financial obligations had to be incurred. I have known Colonial doctors who would push ahead with the advance guard to the halting-place for the night, and who would fearlessly seize upon every good thing which might be in the place for the benefit of the sick; whereas a medical officer of the Regular Service would hesitate to commandeer so much as a solitary chicken, lest he might be contravening some order, or running a risk of official displeasure. In my advance from Bloemfontein to Pretoria I was singularly fortunate in having as the P.M.O. to my force Colonel Williams, now P.M.O. of the Australian Commonwealth. I will give one example to show the sort of thing a Colonial will do, and a Regular, generally speaking, will not, or cannot do. After the fight at Doornkop, by Johannesburg, we had some 250 sick and wounded. Next day we marched into the mining village of Florida, and early on the following morning Colonel Williams asked my permission to visit Johannesburg to make some arrangements for his patients. Although Johannesburg was

in a very unsettled state, I had such reliance on his judgment that I allowed him to go. During the forenoon of the next day he asked me to go round his hospitals. I did so, and was surprised beyond measure to see what he had accomplished in so short a time. The officers and men were in clean and airy buildings, in bed in many cases, with sheets, and in all cases with sufficient blankets. Three civilian doctors had been engaged in Johannesburg, and were in attendance, as well as several nursing sisters. There were table-cloths on the tables, and even vases filled with flowers. The men looked happy and comfortable, and I should have been proud at that moment to have received an inspection visit by the Royal College of Surgeons. It will be observed that the entire responsibility for engaging these doctors and nursing sisters, and for purchasing or for commandeering beds, sheets, and extra blankets, was cheerfully incurred by Colonel Williams, without even troubling me with a reference, which, indeed, under the circumstances, would have entailed at least twenty-four hours' delay.

"Now, I may be wrong, but I think there are few officers in our Departmental Service who would take these financial risks; they would be intimidated, justly or not, by the dread of an interminable correspondence, which might end in a censure or in a heavy pecuniary loss. The Colonials, on the other hand, had never been checked for taking responsibility."

Lieutenant-General Sir Chas. Warren, G.C.M.G., K.C.B., recorded his views as follows:—

"From the purely medical point of view the skill, zeal, and devotion to duty of our Medical Officers during the war is beyond all praise. From the sanitation point of view there is much to be desired. It never seems to be clear whether a camp is located according to strategic requirements or not, or to what extent the question of sanitation is to be considered. The result is, there were grave defects in the position of many of our camps. The duties of Medical Officers ought to be more clearly defined, and their responsibilities laid down. It is possible that sanitation is not yet clearly understood, and that scientific and medical opinions are not in unison. . . . I am convinced that typhoid fever does not belong of necessity to an army in the field; its presence is usually a sign of neglect of some kind. Wherever real sanitary precautions are taken it is at once reduced to a minimum. If there had been efficient sanitary regulations in our Army, and if they had been attended to, I think that three-fourths or four-fifths of our losses from typhoid fever would have been avoided. I consider that our regulations have been retrograde in late years. The whole sanitary service requires re-casting. The only safe expedient is to establish a rule that whenever a case of typhoid fever occurs the Medical Officer and Royal Engineer Officer will be liable to trial by court-martial unless they can show that they have adopted all precautions."

THE END.

Extracts.

EXTRACTS FROM AN ARTICLE BY DR. MATTHIOLIUS ON "JAPANESE HOSPITALS IN WAR TIME."[1]

Oberstabsarzt Dr. Matthiolius, after noting the friendly reception and facilities for seeing everything given him by the Japanese medical authorities, proceeds to describe the hospital ship *Kobe Maru*.

Under the direction of Dr. Honda, this vessel was transformed in a very short time from a passenger ship into a very efficient, comfortable hospital ship, and is now employed for the reception of wounded, the performance of major operations, to provide medical aid for ships which do not carry surgeons, as a hospital for the reception of sick, and for the transport of sick to Japan.

Its general arrangements are as follows:—The sick wards are placed on the main deck, and divided thus: In the fore part of the ship there is a ward with 72 swinging beds for medical cases. Separated from this is a smaller ward of 6 beds for infectious cases, with separate arrangements for ventilation. A padded cell for insanes, with a commode, the pan of which can be removed from outside through a sliding door. For sick officers 9 berths have been arranged in cabins. The main saloon is in the after part of the ship, and is easily reached by a broad companion. Here 78 swinging cots are suspended in two rows, one above the other, so that each cot has a free space all round it. A roomy lift, capable of taking a wounded man on a stretcher, runs from this ward to the ante-room of the operating theatre, situated on the after deck immediately above. Here the cases are prepared for operation. This lift also serves to convey freshly-admitted sick from the upper deck to the ward. The preparatory room, as well as the adjoining operating theatre, are fully equipped with hot and cold water, electric light, steriliser for instruments, &c., for aseptic surgery. On the upper deck the following supplementary equipment is situated: Steriliser for dressings; a large disinfector, in a special chamber, separated into two parts by a partition wall; a steam laundry; an X-ray room and dark room; a mortuary fitted up for the performance of *post-mortem* examinations; a well-equipped pharmacy and a room for chemical analysis. There is also a workshop for the cutler in charge of the instruments, and a sick inspection room for attending patients. The promenade deck is supplied with seats for the sick, and is attractively arranged for patients to spend their time in the open.

Carriage of Wounded to and from Ship.—During my visit to the

[1] Militärärztliche Zeitschrift, heft 10, 1904.

hospital ship, *Kobe Maru,* I asked and was granted permission to witness the method in which wounded are conveyed on board ship. This is carried out by means of a stretcher similar to our (German) naval one; for lowering or hoisting patients the stretcher is slung by means of two long and short loops to the hoisting tackle. At the same time another arrangement is also used, which is similar to our transport hammock. This is constructed of bamboo sticks about $1\frac{3}{4}$ metres (7 feet) in length, split lengthways, and the pieces, placed parallel to each other, sewn on to thick canvas. In this way a rollable but firm support, like a Japanese bamboo screen, is formed; the upper end is fashioned like a reversed lyre, and is broader than the lower end. At the lower end there is also a kind of pocket arrangement. This support is laid out on deck, the wounded man is placed in it, and the curtain is rolled around him, leaving his face free in the broad opening, the body being enclosed, as it were, in a grocer's paper screw, the lower opening of which is fastened with a running string. The whole is firmly closed by straps which are fastened around the wounded man, who seemed quite comfortable during the process of being lowered from the promenade deck into the launch. For lowering over the side of the ship ropes with rings are fastened to the head and feet ends; the former is attached to the hoisting tackle, while two guiding ropes are made fast to the latter. The advantage of this arrangement is that, besides embracing the wounded man firmly, and protecting him from injury while being hoisted, it occupies the smallest possible space, and so permits of transport in narrow passages, such as in the interior of military masts, along engine-room passages, &c.; this arrangement, moreover, is especially suited to small craft.

The Japanese have in all seven hospital ships, assisted by ordinary transports, which are continuously employed in transporting sick and wounded from the field to the base hospitals in Japan. They thoroughly recognise the fact that in modern campaigns the sick are more numerous than the wounded, hence they have adopted special measures to obviate, as far as possible, the occurrence of disease.

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They have a regulation for clearing the field after an engagement, which orders that the identity of the dead is first to be established, the larynx and some hairs of the head are then removed and sent to the relatives, after which the bodies are cremated. Dead horses are burnt on the battle-field. The Russian dead are buried with full military honours. The head of the department for the prevention of disease travels about visiting ports and camps, and issues such orders as he may consider advisable.

Among the sick were a number of typhoid and dysentery cases, but these only formed a small proportion of the whole. There seems to be more beri-beri, or, as the Japanese call it, "kakke," although the cases were of a mild type. This disease appears to be endemic in Corea, China

and Japan, and probably the hot moist months have predisposing effects. The Japanese commissariat have used every endeavour to vary the diet of the troops, but still there is a certain unavoidable sameness, due to difficulties of transport. The Japanese commissariat is excellent; thus, according to the newspapers, the advancing troops in Corea were preceded by small detachments whose duty it was to arrange supplies of food. Tobacco and alcohol, in the form of *Sake*, is included in the Japanese army ration. The latter is only issued in small quantities and on special occasions.

Hospitals in Japan.—As regards the hospitals in general, they have made a most excellent impression on me. Unfortunately I was only able to inspect the military hospitals in Japan itself, and see the arrangements there for wounded brought back from the front. I saw the hospitals in use prior to the war, and those which were specially erected during the war. The appearance of the patients, wards, and the nursing staff spoke well for the care taken of the sick. These were always placed in roomy, airy, temporary buildings; the sick appeared to be well fed and cared for, and the bandaging was a model of correctness. The temporary hospitals, constructed of bright yellow wood, and charmingly situated in gardens and shrubberies, made a very pleasant impression. These buildings were connected with each other by covered wooden ways, so that even in the wettest weather it was possible to get from one to the other dry footed. Before entering any of these buildings boots have to be removed, and one can either enter in stockings or specially-supplied slippers. This custom, in my opinion, does much to maintain the cleanliness of the wards.

Every hospital has an operation room and a room for preparing the cases for operation. These were fitted up in the most approved fashion, and, judging by the excellent appearance of cases operated on, the surgical staff thoroughly understand how to make the most of their equipment.

The discipline appeared to me to be excellent everywhere, and I would lay special stress on the fact that this applies equally to the female *personnel.* I should like to note the following incident, which illustrates the thorough discipline which even the nurses do not consider it derogatory to submit to. One day, in company with the young officer detailed by the district commander to conduct me, I was driving from one hospital to another. On the way we met a squad of nurses. As soon as these noticed our uniform they halted, and bowed by way of salute. I do not think I am wrong in regarding this as a sign of the way in which the Japanese nurses regard their position; indeed, on all occasions this view has been confirmed.

Case sheets appeared to be kept for every patient. In the case of wounds a very extensive use was made of small but distinct drawings in order to explain the exact nature of the wounds. . . .

The operations which appeared to me most frequent and necessary in base hospitals were extirpation of aneurysm, and resection of nerves.

Except in the case of the wounded from the *Variag*, such operations as the removal of splinters of bone, of fragments of shell and pieces of clothing, had been, as a rule, performed in hospitals at the front. In all the hospitals which I visited there was only one case of amputation. Surgeon-General Kihonchi informed me that, although most of the cases of gunshot injury to bone were inflicted at a lesser range than 700 yards, still, as a general rule, it was rather exceptional to find much comminution of bone. As regards head wounds, in many cases these were followed by paralysis and other disturbances of function; little hope appeared to be entertained of ultimate recovery in these cases. As regards abdominal wounds, the general rule observed was not to operate unless there were signs of urgent hæmorrhage. Very few bayonet wounds appeared to reach the military hospitals in Japan; the Japanese surgeons, however, report that many of their dead had wounds that had presumably been inflicted by the bayonet.

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Surgeon-General Kihonchi showed me a very cheap sterile and absorbent dressing, originally introduced by him, which can be improvised anywhere. This consists of straw ashes wrapped in sterile muslin. He informed me that this dressing keeps very well, and the results, as shown by the appearance of the Russian wounded, vouched for his statement.

Reviews.

"The Treatment of Syphilis." By Lieutenant-Colonel F. J. Lambkin, R.A.M.C. London: Baillière, Tindall and Cox, 8, Henrietta Street, Covent Garden (1905).

In this little book Lieutenant-Colonel F. J. Lambkin has published his views on the treatment of this disease. Lieutenant-Colonel Lambkin has made a special study of this disease in the army, and was the first to advocate the injection treatment of syphilis for soldiers. He has now had some fourteen years' experience of this subject, and his opinions are entitled to careful consideration. In the present work he deals mainly with one form of treatment, that is, the injection of mercurial cream. That this is an excellent method of treatment in the army cannot be doubted, but as to whether patients in civil life would take kindly to it is quite another matter.

The author makes two statements which are perhaps generally accepted in England, but are certainly not so by all Continental specialists. These are:—

P. 6, in talking of the cardinal principles of treating syphilis, "That it (mercury) be given in small doses uninterruptedly over a long period."

What we would object to is the word "uninterruptedly." The German and French, and even some English specialists, insist on interrupting the administration of mercury for shorter or longer intervals. These gentlemen are satisfied with their results, and would not endorse Lieutenant-Colonel Lambkin's first cardinal principle. If Lieutenant-Colonel Lambkin means this to be taken as one of his own cardinal principles no one can object, but as it at present stands, it reads as if he understood the acceptance of it to be general.

P. 48, when to begin mercury. "It has been an accepted axiom for a great many years that the earlier mercury is given the more it modifies the after-symptoms and signs of syphilis," &c.

The Germans, whose views and experience in the treatment of syphilis should not be ignored by any writer on the subject, do not endorse this view. They, in fact, rarely give mercury till secondary symptoms have appeared. This is not merely to gratify the patient's curiosity, as suggested by Lieutenant-Colonel Lambkin, but to settle the diagnosis definitely, and ensure that a thorough prolonged course of treatment will be carried out. In the army this question is not so important, as the soldier is under control, but in civil life the patient who has never seen any sign of the disease beyond a primary sore, is very likely to abandon treatment before completing a thorough course, and to suffer from severe tertiary symptoms. The Germans, as the result of their experience, do not admit that the after-symptoms of syphilis are any way aggravated as the result of withholding mercury till secondaries have appeared. The case quoted on p. 50 seems a very unusual one, and as far as the description of the symptoms goes, the lesion might equally well have been due to some cause other than syphilis.

What we miss and expected to find are some definite statistics supporting the writer's views. Mere statements, such as "my experience as a syphilis specialist in India," have little value. Lieutenant-Colonel Lambkin should explain, for the information of the public to whom his work is presented, how long he was a "syphilis specialist in India," what opportunities he had of observing, and how many cases he observed, during this period. Again, "a great many of these cases I have been able to observe for some years afterwards, and I can say with truth that not one of them has relapsed or had any return of the disease." While not doubting the author's experience, we think that he should have given some figures in support of this statement, showing: (1) That the diagnosis of syphilis was beyond doubt; (2) treatment adopted; (3) how long they remained free from further signs of syphilis. Lieutenant-Colonel Lambkin must forgive us if we are seemingly severe on this portion of the work, but he must know how important it is to show the actual facts on which his statements are founded.

In a work on the treatment of syphilis, it would be well to go more fully into the various drugs used in treatment by the mouth, with a short notice of the advantages claimed for each. Modifications of treatment for some of the special manifestations of syphilis, *e.g.*, the palmar syphilide, sloughing gummata, mucous patches on the tongue, &c., might also be indicated with advantage.

In our opinion the work hardly does justice to its title. If Lieutenant-Colonel Lambkin had issued this work in pamphlet form with some such title as "A plea for the treatment of syphilis by the injection of mercurial cream," and added some statistics to support his undoubtedly favourable experience of this treatment, in our opinion he would have made an important addition to the literature of syphilis and its treatment.

The work can be strongly recommended to anyone who wishes to try this method of treatment, and no doubt if Lieutenant-Colonel Lambkin's advice is followed they will soon become as enthusiastic as himself.

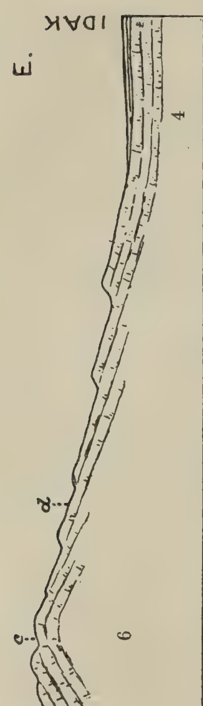
One statement in the preface has evidently been copied from General Maurice's article in the *Contemporary Review*, viz., that 60 per cent. of would-be recruits are rejected annually as unfit to serve. This cannot be allowed to pass without comment. The actual figures for the period 1893 to 1902, are "rejected on medical examination," 34·6 per cent.; "within three months' service," 0·9 per cent.; "under two years' completed service" 2·1 per cent. which reaches a total of 37·6 per cent. of recruits who are rejected, or break down within two years' service. To this must be added the unknown number rejected by recruiting sergeants, without being brought up for medical examination.

Geology of the Tochi Valley.

The *Geological Magazine* for October, 1904, contains a "Note on Two Cephalopods, obtained by Lieutenant-Colonel Skinner, R.A.M.C., from the Valley of the Tochi River on the North-western Frontier of India," written by Mr. G. C. Crick, F.G.S., of the British Museum (Natural History).

The district through which the Tochi River flows is, generally speaking, one built up of rocks of Eocene age. The special interest attaching to these fossils is that they bear out a conjecture of Mr. F. H. Smith's (of

the Indian Geological Survey), that the anticlinal to the east of Mirám[1] Shah contains a core of Mesozoic age. As the point is one of some importance from a geological point of view, we publish drawings (kindly lent by the editor of the *Geological Magazine*) from Mr. Crick's paper of a section through the locality named, and of the fossils obtained from there and described by him. Such of our readers as are stationed within reach of Mirám Shah may thus perhaps be assisted in further elucidating the question of the exact age of the anticlinal, and may be fortunate enough to discover complete specimens of the cephalopods *in situ*. Should they do so, we would advise their despatching them to the "Keeper of the Geological Section, British



Section from Idak to Mirám Shah. 4, 4, Middle and Lower Nummulitic beds; 6, Mesozoic (?) Limestone. *a*, Coral limestones; *b*, branching coral; *c*, ammonoid; *d*, Belemnite. (After F. H. Smith, "Records Geol. Survey, India," vol. xxxviii., pt. 3, 1895, pl. iii.)

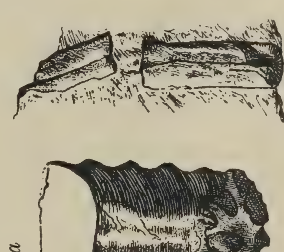


FIG. 1.—Belemnite from Mesozoic rocks (Neocomian ?) between Mirám Shah and Idak, Tochi River district, North-west India. The fissure traversing the specimen longitudinally is of the nature of a crack and not a groove. Drawn from the specimen [register number C. 9296] in the British Museum (Natural History).

FIG. 2.—Ammonoid (*Crioceras* ?) from Mesozoic rocks (Neocomian ?) between Mirám Shah and Idak, Tochi River district, North-west India. *a*, Peripheral or ventral aspect; *b*, lateral aspect; *c*, dorsal aspect; *d*, transverse section showing asymmetry of the whorl. Drawn from the specimen [register number C. 9297] in the British Museum (Natural History).

[1] Sometimes spelt Mirán Shah.

Museum (Natural History), Cromwell Road, S.W.," to enable him to add to the information available on the subject.

B. S.

The *Geological Magazine* for July, 1904, contains a paper by Captain P. S. Lelean, R.A.M.C., describing the locality of an Eocene outcrop in Central Africa. The locality is described, and is illustrated by a sketch map indicating the surface markings in the neighbourhood of Garadimi in the district of Sokoto. There is also a section to show the spur, at the base of which the fossils marking the age of the rocks were found. Their original site was in a limestone which lay between two layers of volcanic rock. Captain Lelean brought the fossils to England, and handed them to the palæontologists of the British Museum, one of whom, Dr. F. A. Bather, describes and illustrates them in a subsequent paper. The fossils comprise four echinoids, five casts of Mollusca, and some rock specimens containing *Operculina* and other Foraminifera, all of which indicate that the above-noted limestone is of Middle Eocene age. The fossils obtained by Captain Lelean, as well as others found by English and French officers, bear out the continuity, evidenced by the similarity of certain fossils, of the great Eocene sea which extended once from what is now the West Coast of Africa up to the Western Himalayas.

We must conclude this note by cordially endorsing Dr. Bather's remark, "It is fortunate that Captain Lelean not merely discovered these fossils at Garadimi in Sokoto, but that he had enough sense of their importance to spend some time and trouble in their collection, and that now he has generously presented them to the British Museum." We must add that we hope other R.A.M.C. officers will follow Captain Lelean's example, and thus help to increase the common stock of knowledge of the geology of places hitherto but little known.

B. S.

Those interested in Zoology will find in the *Annals and Magazine of Natural History*, section 7, vol. xiv., for August, 1904, a description of mammals, including some new forms, collected in Central Somaliland during the recent campaign there, by Major H. N. Dunn, R.A.M.C., and presented by him to the Natural History Museum. The collection contains examples of a fauna adapted by its coloration to "the red sandy and stoneless Haud," its vivid reds assisting in its preservation. On the other hand, the reduced size of certain predatory types may perhaps be an advantage to the latter in approaching their prey in a country where cover is absent.

Such of our readers who may have had opportunities of making collections will do well to follow Major Dunn's example by presenting them to the National Museum, where they may become of use in extending our knowledge of Natural History.

B. S.

"Compounding and Dispensing made Easy." By H. Harold Scott, M.B.Lond., M.R.C.S.Eng., L.R.C.P.Lond., Lieutenant R.A.M.C. Gale and Polden. (Cr. 8vo, pp. 322, 7s. 6d.)

The subject of this little book is well arranged, the style is simple and concise, and, with the exception of elementary chemistry, the author has

brought together in one volume all the information required for the corps examination in compounding and dispensing. The book is divided into six sections. In the first, much useful general information is given regarding dispensing, technique, prescription reading, incompatibility, &c. The next three sections deal with materia medica and pharmaceutical processes; and a special feature of this part of the book is that the acquirement of a knowledge of pharmacopœial preparation is facilitated by well-arranged grouping. The fifth section treats of the common forms of poisoning. The last section gives details of the six army forms, with the nature and method of preparation of which every compounder must be familiar. Lieutenant Scott is to be congratulated on having provided a book which should prove of service to non-commissioned officers and men of the Corps who are preparing themselves for examination, and the book should also be useful to officers engaged in the instruction of classes.

Current Literature.

The Campaign against Malaria in Madagascar in 1903.—In a communication to *Le Caducée*, No. 15, 1904, Dr. A. Billet praises General Galliéni for the many and important sanitary improvements he has effected in Madagascar. Among these may be enumerated the provision of medical assistance in the various provinces; the creation of a special body of native midwives, a native medical school and hospital, but especially, measures for the diminution of small-pox and malarial fevers. The latter are extremely common in certain provinces, particularly during the rains, from March to the end of May.

The recrudescence of epidemics is due to the fact that the natives, instead of, as formerly, allowing the rice fields to dry up after the crop has been gathered, now inundate them, so as to accelerate the putrefaction of the roots. Whole regions are thus transformed into huge swamps, in which the larvæ of mosquitoes, especially of certain species of Anopheles (*A. costalis*, *A. squamosus*, and *A. coustani*), swarm. General Galliéni has strongly advised a return to the old plan, that of allowing the rice plants to dry after the harvest.

The prophylactic administration of quinine has proved very efficacious amongst the natives. By order of the Governor-General notices are posted up in all the villages recommending the use of the drug, which is gratuitously supplied, not only by medical officers, but by all the governors of the principal districts, in packets containing two grammes. For prophylaxis this quantity makes eight doses, of which one is taken daily; for curative purposes twice the quantity is taken.

Special care is taken of travellers, *e.g.*, of those who have to pass from one railway workshop to another. A form is given to each, which he presents every two days to some sanitary authority, who administers half a gramme of quinine. In some epidemics hypodermic injections (half a gramme of hydrochloride of quinine) have been used with great advantage in thousands of cases, with complete absence, it is said, of any local complication. The natives come and ask for this treatment, which they call "vaccination for fever."

General Galliéni has likewise organised mosquito brigades for the destruction of the insects as far as possible, and has tried the mechanical protectors (metallic wire fitted into window frames) for a barrack about to be occupied by men on their way from France. T. P. Smith.

Mental Disorders among the Russian Troops in Manchuria.—Under this heading the editor of *Le Caducée*, Dr. Granjux, comments (No. 15, 1904) upon a letter from Dr. Jacoby (physician to an asylum in Persia) published in the *Archives d'Anthropologie.* The object of the letter and of the comments thereon is to draw attention to the marked psychical effects of the present war upon the Russian soldiers. As a matter of course, a prolonged campaign is liable to produce mental disorders among those engaged; Granjux refers to his own experiences

in 1870. But in its psychological and psychopathic effects the war now being waged differs entirely from all previous campaigns. Jacoby points out that modern war has ceased to be a more or less personal combat; it is a sort of butchering industry with methods brought to perfection. The dangers of battle, death itself, are presented under new shapes and forms to which the mind is unaccustomed, and which it has not yet grasped. If we take such instances as the battleship with 800 on board sent to the bottom in less than two minutes, the artillery duel in which 104 out of 107 horses were killed, attacks in which all the assailants were killed, explosions of mines and their consequences, we are reminded rather of cosmical catastrophes, such as earthquakes and volcanic eruptions, which so often cause nervous and mental disorder. What must be the state of mind of some of those who escaped during the catastrophes of the present war? It must be remembered that those in any way affected could not be properly treated. We may well expect that novel forms of death and the mental conditions created in the survivors should give rise to new forms of mental disorders.

It would seem that this expectation has been realised, so far as the Russians are concerned. Many have been sent to Moscow by special train. There are no special lunatic asylums in Siberia, and of course none in Manchuria. In Siberia some of the provincial hospitals have insane wards, but these are in a very unsatisfactory state. Jacoby says that to send the sufferers 10,000 kilometres by rail is to destroy all chance of recovery. Such victims of war are easily forgotten. Granjux admits the difficulties of treating such cases on the spot. They would require to be removed to a locality at some distance from the base of operations and the movement of troops. He agrees with Jacoby that there ought to be a special psychiatric service for troops in war, and particularly in tropical and semi-civilised countries.

In the following number (16) of *Le Caducée* it is stated that *three* military hospitals for the insane are to be established at Irkoutsk, Kharbin and Tehita to deal with the increasing number of cases in the Russian Army in the East.

T. P. Smith.

Béraneck's Tuberculin in the Treatment of Pulmonary Phthisis, by Dr. Paris. *Rev. Med. de la Suisse Romande* (October 20th, 1904).—Professor Béraneck prepares two toxins, *Basitoxines* (T. B.) and *Acidotoxines* (A. T.), the former by cultivating the tubercle bacillus for two or two and a half months in a veal broth alkalinised by calcium hydrate, filtration, and evaporation *in vacuo*, the latter by washing carefully, drying *in vacuo*, and treatment with a 1 per cent. orthophosphoric acid. The tuberculin is then made by mixing equal quantities of T. B. and A. T. previously diluted. Of this tuberculin 1 c.c. is diluted with 19 c.c. of sterilised distilled water; this solution (strength $\frac{1}{20}$) forms the standard solution from which the different concentrations injected are prepared.

Treatment is begun by mixing 0·10 c.c. of the standard solution with 9·90 c.c. of the sterilised physiological solution of sodium chloride; 1 c.c. of this is injected daily under the skin of the arm and back till the 10 c.c. are finished; then 0·25 c.c. of the standard is added to 9·75 c.c. of the sodium chloride solution, and the resulting 10 c.c. used in the same way as before, 1 c.c. being injected daily. The doses are steadily increased (unless

the remedy causes too powerful reaction) in this fashion till the strength 5 c.c. of the standard to 5 c.c. of the diluent is reached, or even 7 T. to 3 of the diluent.

In a general way the management of the treatment, the phenomena to be watched for, are those we are familiar with in using Koch's tuberculin: rise of temperature is common, varying with the extent of the tuberculous disease, general malaise, headache, slight shiverings, profuse perspirations, &c. The symptoms are of but short duration. There is very little local congestive action round the lesions, and the treatment may be practised even in those who have had hæmoptysis. Cough and expectoration are at first increased; the expectoration then becomes more liquid and more easily brought up, contains at first increased numbers and then fewer and fewer bacilli, and those broken up and less deeply stained.

This tuberculin seems to establish a condition of system unfavourable to the growth of the bacillus, while at the same time it facilitates the elimination of the micro-organism. Cases with intestinal complications are less favourably influenced by the remedy than those without.

During the past four years 65 cases have been treated, 34 men and 31 women; of these 14 were in the first stage, 19 in the second, and 32 in the third. Results of treatment: All the 14 suffering from the disease in its first stage were cured; of the 19 in the second stage 7 were cured, 6 improved, 3 stationary, 3 died; of the 32 in the third stage none were cured, 1 was improved, 7 became stationary and 24 died. As regards the sense in which the foregoing terms are used the author makes the very sensible remark that it is risky in all that concerns tuberculosis to speak of "cure" without very prolonged observation, the term "conditional cure" being certainly preferable. He classes as "improved" those in whom the symptoms, clinical and bacteriological, are simply lessened in degree; as "cured" those in whom the symptoms have completely disappeared.

In surveying his results the writer puts his cases into three groups: (*a*) Those in which the effect of the tuberculin was positive—a lasting improvement or conditional cure; (*b*) those in which the effect was simply an arrest in the evolution of the disease—the stationary cases; (*c*) those in which there was no effect at all, or only a very temporary amelioration. In class (*a*) were 43 per cent., in class (*b*) 15·4 per cent., in class (*c*) 41·6 per cent.

Dr. Paris sums up in the following conclusions:—

(1) Béraneck's tuberculin has a distinctly curative action at the commencement of a pulmonary tuberculosis.

(2) This curative effect is obtained even in cases in the second stage.

(3) In advanced cases there is amelioration and prolongation of life.

(4) The tuberculin at first increases the amount of expectoration.

(5) It promotes elimination of the bacilli, their transformation and their disappearance.

(6) It is entirely innocuous, causing neither complication nor aggravation.

(7) In more than 5,000 injections there was no case of local abscess.

(8) It remains still to be determined what are the forms of tuberculosis most readily influenced by the tuberculin. This can only be established by a large number of observations.

(9) If Béraneck's tuberculin is not the curative remedy *par excellence*

for tuberculosis, it is at least a powerful agent in treatment, and even of cure, when used at the outset of the disease.

The author finishes his interesting paper by giving details of nine cases belonging to the various groups he mentions.

A. Napier.

Natural Immunity of Dog-faced Monkeys to Trypanosomiasis: Action of their Serum upon Trypanosomes.—In a short communication to *Le Caducée*, August 6th, 1904, Laveran states that several observers have noticed the natural immunity of cynocephalic monkeys to trypanosomiasis, which is easily inoculable upon other kinds. He endeavoured to discover whether the serum of the former had any prophylactic or curative action. His first experiment, made upon rats infected with *Tr. gambiense*, ·50 gramme of the powdered serum being used for rats of 127 and 205 grammes, gave negative results. Another experiment made with a relatively much larger dose (·2 gramme for a mouse weighing 18 grammes) yielded a decidedly positive result. The organisms, very abundant in the mouse's blood, disappeared in forty-eight hours. This condition lasted for three days; a few could be afterwards found.

In Surra, Nagana and Mal de Caderas, injection of the same quantity of serum was followed by the same result in mice (of at least 20 grammes); the trypanosomes disappeared for several days and life was prolonged. One such mouse infected with Surra and treated with serum, lived fourteen days; while another, not so treated, died in eight days. Still more favourable results might doubtless be obtained by repeating the serum injection after a few days.

It has been already shown that normal human serum has a destructive effect upon the organisms of Nagana, Surra and Caderas. This fact is comparable with that just described. It may be added that the activity of the monkey serum upon *Tr. evansi*, *Tr. brucei* and *Tr. equinum* is less than that of human serum.

T. P. Smith.

Mediterranean Fever in Tunis.—Mons. C. Nicolle believes that cases of this fever occur in Tunis (*Le Caducée*, November 19th, 1904). He points out that the existence at Malta of a peculiar disease called "undulant fever," "Mediterranean" or "Malta fever," had not been definitely admitted until Bruce had obtained the *Micrococcus melitensis* from the spleens of the affected persons and reproduced the disease by inoculating monkeys with the cultures. In addition to Malta, certain spots on the Mediterranean littoral would seem to contain cases of the disease, though in the majority of the localities absolute proof has not been obtained. Such has recently been the case in Northern Africa, and especially in Tunis, where the question as to the nature of the disease has caused differences of opinion among physicians. Some think that Malta fever is endemic and common in Tunis. Others say that they have never met with cases of that disease, and regard their colleagues' reports as indicative of abnormal forms of paludism, of enteric fever, of tuberculosis, or of some gastro-intestinal infection.

Since Nicolle's arrival in Tunis he has tried to solve the problem by two experimental methods — the sero-diagnostic, instituted by Wright (1897) and the discovery of the specific agent. The former plan was

adopted in six cases, presenting the ordinary clinical features of Malta fever. In three, the blood had no agglutinating power at a dilution of 1 in 1; in two cases there was slight activity, and the same in one case at 1 in 2. No useful diagnostic indication could be drawn from these results.

In four of the patients an attempt to isolate the microbe by puncturing a vein during life yielded only negative results. A similar failure had been experienced in all previous attempts. In a certain number of cases the *M. melitensis* has been isolated from the spleen after death. Nicolle has never had an opportunity of making this experiment. He was, however, successful in isolating the microbe by puncturing a patient's spleen on the twenty-sixth day of infection, during an apyretic interval. The microbes proved to be identical in all respects with three specimens of the *M. melitensis*. He regards the question of the occurrence of Malta fever at Tunis as settled; its frequency remains to be investigated.

T. P. Smith.

Hæmoglobinuric Fever and Quinine.—This subject was discussed at a Congress at Grenoble of the French Association "*pour l'avancement des troupes*," by Dr. Marchoux, of the Pasteur Mission at Rio-de-Janeiro (*Le Caducée*, August 20th, 1904). He thinks that the view advocated by himself at the Paris Congress in 1900, that the drug is the cause of the urinary symptoms, has gained many supporters in the interval. That the connection was not more generally admitted, is due to the fact that the physician who observes the symptom has often not administered the medicine. The testimony of the patient is therefore the only evidence with regard to the latter.

He refers to a case seen by him at Dakar, and which he regards as unique. Quinine had been administered to the patient on the day of his admission into hospital. The drug, however, could not be detected in the urine while the hæmoglobinuria continued; but when the urine became clear the quinine appeared, although none had been administered during the three days which had elapsed since he was admitted. We know that ordinarily, a few hours after quinine has been taken, it can be discovered in the urine as a white, flocculent precipitate, on the addition of a small quantity of the solution of the iodides of mercury and potassium. But Marchoux has never discovered the drug, after precipitating the albumen by heat, and decolorising the urine stained by the hæmoglobin. It follows that quinine is not eliminated during the continuance of the malady, the process does not take place until convalescence sets in. It is in the retention of the drug, and the causes whereby such retention is produced, that we must look for the origin of the hæmoglobinuria. In every case the reaction of the urine allows at least of the verification of the suggestion that quinine has been administered before the physician had seen the case.

T. P. Smith.

Frambœsia at Pondicherry.—In *Le Caducée*, August 6th, 1904, Dr. Gouzien, Principal Colonial Surgeon, gives some details of a case of frambœsia, and states that he has treated 62 cases in hospital during the years 1887 to 1902. He denies that the disease is most often a manifestation of syphilis, while admitting that marked analogies exist between

the two diseases. It is even true that specific treatment sometimes acts very favourably upon the eruption of yaws, though it is impossible to exclude the effect of hygienic treatment during the administration of mercury and the iodides. Spontaneous disappearance of the symptoms is also sometimes witnessed. The spread and persistence of yaws are often due to the habits and carelessness of the patients; with proper care the virus of the disease tends to become exhausted.

With regard to the parts most often affected by the growths, Gouzien emphasises their predilection for the borders of the natural orifices, without constantly involving the mucous membrane, and thus differing from syphilis. In a case of the disease, of which two illustrations are given, the patient was a coolie, aged 42, having been infected by the village children, and the disease having existed for six weeks. He had not had syphilis, but complained of nocturnal pain over the left tibia. He was treated by sulphur baths, mercurial frictions, iodide of potassium, and boric acid ointment to the sores. In fourteen days, being nearly well, he demanded his discharge, in accordance with the usual custom. A complete cure of the disease is not desired by the mendicants, who make a living by exposing themselves in fairs, markets and processions.

T. P. Smith.

Disappearance of the Tsetse-Fly.—Reprinted from the *Natal Agricultural Journal and Mining Record*, No. 10, vol. vii., October 28th, 1904. Mr. J. W. Arnold, of Arnold's Hill, has been good enough to communicate to us some information with relation to the disappearance of the Tsetse-Fly from one of the worst Fly, or Nagana affected, districts of Zululand. The presence of Tsetse-Fly, as colonists who have travelled in Zululand and further north know, means death to all domestic animals—cattle, horses, donkeys, dogs, &c. In 1895 Colonel David Bruce, R.A.M.C., F.R.S., at the request of the Hon. Sir Walter Hely-Hutchinson, then Governor of this Colony, proceeded to the Lebombo district to investigate the disease. By experiment Colonel Bruce established beyond dispute that the Tsetse-Fly in itself is innocuous, but is the medium of the disease which goes by its name; that is to say, the disease germ inhabits the blood of certain wild animals and the Fly, after having fed on such blood, transmits the germ to any domestic animal it may, for a time, subsequently feed on. The subject is of striking interest in all its aspects, and in his report Colonel Bruce treated it with both interest and simplicity. Those who wish to pursue the subject will find a summary of the report referred to in No. 19, vol. i.

This is what Mr. Arnold related: "Eight years ago last August, I was on a hunting trip in Zululand, and for some time was shooting this side of the white Umvolosi, near the junction. The game was thick—buffalo, koodoo, waterbuck, zebra, rietbuck, rhebuck, &c. The Fly was bad then, my boys suffered a lot from their vicious bites, and so did I, for they bite right through one's clothing. I left my waggon at Sogaxile's kraal, on the edge of the Thorns, just before the land drops into the game country. When I finished shooting I took a sledge down with six oxen to bring back my kit and the skins I had got. Out of the six oxen three died. The oxen began the journey after sundown and were back on the high veld a few hours after next morning's sunrise. Only two or three hours at the most were they in the Fly country while the sun was

up—the only time the Fly is at work. On one occasion I rode my horse down. I left after sundown and the horse was back at the kraal by about nine o'clock on the following morning. He caught the disease. The dogs I had with me died, but they were with me the whole of the time I was in the Imvamanzi Valley—about a month. That is how the Fly disease was then. Now for the change. Last August, when on a hunting trip in Zululand, I again made for Sogaxile's kraal, intending to leave my waggon there while shooting over the same ground again. The kraal was moved, and I found that it was located in what I had, eight years previously, found to be the worst part of one of the worst Fly districts of Zululand. Their cattle, goats, dogs, &c., never died from Nagana, and they assured me that the younger members only knew of the disease by name. All the district they told me, was now clear, and later on I heard the same from Harry Dunn, the eldest son of the late John Dunn."

Mr. Arnold did not know to what to attribute the migration of the pestilent insect, and could only hazard a guess that the rinderpest epidemic of eight years ago had destroyed so much game that the Fly, finding its food so diminished, had departed for the north in search of better supplies. Game in this part of Zululand, however, is plentiful again, a fact, he admitted, which seemed to weaken the theory.

About the causes of Fly migration nothing is yet definitely known. Wherever big game and wild animals are found along the coast belt there is no assured safety from Fly. A district may be clear of the pest for a year or longer and then become as bad as ever. Colonel Bruce, in his report, refers to these epidemic characteristics of Fly fever.

Mr. Arnold had promised to collect some specimens of the Fly for the veterinary department, but he failed to get any.

Correspondence.

SPITTING SNAKES.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—I read Col. Bartlett's article on the African cobra with great interest, on account of the similarity of his cases with mine.

In British Central Africa, and Zambesia generally, there is a snake corresponding in all particulars, as far as I can remember, with the description given by Col. Bartlett. This is the black "mamba," the most poisonous snake, according to the natives, in the locality, and so called to distinguish it from the green "mamba," a snake I have never seen. One I killed was 3 feet 7 inches in length, but I believe they are found larger than this. It has the cobra hood, and rises, when attacked, to strike.

The first case I saw was in 1898, in Central Africa, a native coming up with œdema of the eyelids and congestion of the conjunctivæ, saying a "mamba" had spat at him. The second case, also in Central Africa, in 1902, was that of an officer who had a large chicken run, and whose fowls mysteriously died. One afternoon his servant called him and explained that he had seen a "mamba" returning from the chicken-house to a rockery in the garden, into a hole of which it had entered. Armed with a sword, he endeavoured to dislodge it, but was attacked from another opening, and was struck in the eye. For several days there was in this case, also, œdema of the eyelids, congestion of the conjunctivæ, severe pain, and photophobia.

I may add that this habit is well known to the natives.

I am, &c.,
HALLAM HARDY,
Captain R.A.M.C.

Alton, Hants,
November 3rd, 1904.

REMARKS ON THE FIRST REPORT TO THE ADVISORY BOARD ON THE TREATMENT OF VENEREAL DISEASE AND SCABIES IN THE ARMY.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

DEAR SIR,—Major Pollock's report has just reached my lonely station in the jungle, and I would like, with your permission, to make a few remarks thereon.

The wisdom of appointing a junior officer for this duty is amply exemplified by the enormous bibliography on page 57, the wading through which must have required an amount of energy and application rarely found in more mature officers. I can feel for him, almost submerged in this sea of literature, containing, as he pathetically puts it, "opinions frequently at variance," and I can appreciate his "attempt to classify the more salient points." But it is to this classification

that I take exception, as it shows an amount of bias, natural, no doubt, to an emotional and energetic young man, but which is, or ought to be, foreign to cold and deliberate scientific inquiry. The classification is so arranged that it points to a conclusion which is unjustified by the facts, and favours a form of treatment which is not devoid of danger, and for the adoption of which there does not seem to be sufficient evidence adduced. I think the following extracts will show this to be the case :—

Method of Administering Mercury.

Intramuscular Injections.—At this stage of the report Major Pollock shows marked symptoms of hypnotism. The fascinating essay of the gifted and persuasive Frenchman, Lévy Bing, has evidently been to him an oasis in the dreary waste of Army Medical Reports and Promotion Essays through which he has had to wade. He quotes from this author "almost entirely" for ten pages. He starts by saying that this method gives excellent results in the British Army, and winds up the quotation on page 28 by the astounding statement that 1,500 injections per week were then being administered to the British soldier. Here he is carried away in his hypnotic trance, and he cares not for facts and figures. Fifteen hundred injections per week would mean (at the rate prescribed in the foot-note on page 63) that 5,200 men were then under treatment. The average constantly sick from Secondary Syphilis in 1898 (the most recent complete statistics he gives in his tables) were only 1066·54. Whence this five-fold increase? We must remember that when the report was written systematic treatment of the British soldier for secondary syphilis had hardly yet begun.

Let us see what Lévy Bing's summary really teaches. Of the soluble salts of mercury, amounts corresponding to from 10 to 14 grains of metallic mercury are administered in the first year of treatment, from 7 to 10 in the second, and from 5 to 7 in the third. Then, presumably, the "cure" is effected. Of metallic mercury and its soluble salts 15 grains are administered without any disastrous results, when the regrettable incident of mercurial stasis does not take place. When we compare these figures to the dose of mercury administered by the mouth (two grains in blue pill or grey powder daily) or by inunction, we cannot say that the dose is excessive.

Major Pollock reprints Surgeon-General Fawcett's report in Appendix A, and seems to look upon it as an additional argument in favour of his favourite form of treatment, but even the author of the report hardly makes this claim, as is seen from his summary on page 68.

Intravenous Injection.—This method does not seem to commend itself to Major Pollock, and he quotes on page 29 an officer who recommended Lane's method for out-patient treatment of soldiers, although 50 per cent. of this limited number of cases were unsatisfactory. This quotation shows us through what unphilosophical stuff Major Pollock had to wade in compiling the report, and we can easily pardon his hypnotism, and see that it was almost inevitable.

Inunctions.—The quotation from Hutchinson, on page 14, has evidently influenced Major Pollock, and considering the enormous amount of mercury employed—675 grains for the first course (which is called at

Aix "the cure")—the results are decidedly disappointing, and are apt to shake one's belief in the specific action of the drug.

By the Mouth.—From six months to two years is mentioned as the period during which it is advisable to administer mercury by this method, although there does not seem to be any reason why the course should not be prolonged indefinitely, as, in the absence of the symptoms, it is impossible to say when "the cure" is effected. The remark on page 13 that later Continental writers do not mention any particular time during which the treatment is to be maintained, is significant. Perhaps they only administer mercury when there are symptoms of the disease present.

Action of Mercury.—On the specific action of mercury, he has collected some very definite opinions. The observations of Reiss and Ferrars, showing how quickly it acts as a poison, is very important, and ought to be printed in letters of gold, as also the fact of its being found in the blood as metallic mercury in a fine state of sub-division. This observation is supported by the study of cases of poisoning occurring in certain trades. The statement that mercurial stasis is liable to occur in whatever form administered will not, I think, be generally accepted. This is *par excellence* an accident resulting from the injection of metallic mercury or one of its insoluble salts, and the conclusion of Chotzen, on page 28, is probably correct. There is every reason to believe that the non-absorption is more common than is usually supposed.

The instructions contained in the Director-General's Memorandum in Appendix C are very explicit, and ought in a few years to yield most valuable statistical results, provided officers do not read them in a wrong spirit. "Continuous treatment" of syphilis does not imply treatment by mercury, nor is the expectant treatment, so valuable in other diseases, prohibited.

The must-do-something impulse is the origin of much mischief in medicine and sociology. I am confident that future Army statistics will show us that treatment by mercury of soldiers who are out of hospital, and subject to chill and other vicissitudes of their calling, is unsound. The number of men incapacitated by recurrent syphilis during the late war was very limited, notwithstanding the hardships and depressing surroundings of the Army. Yet a considerable number had had syphilis, and none were given mercury when there were no symptoms to indicate its use.

A philosopher of old used to compare the physician to a blind man with a club, who sometimes struck the disease and sometimes struck the patient. What would he say if he knew that now we have taken to striking at men who probably have no disease?

Prevention of Venereal Disease.

We must be grateful that "the question of prophylaxis has not been fully discussed." In this discussion we have the protectors of the physical health of the community at war with the directors of its moral health. It is a conflict that has raged for many years, and bids fair to last for ever. The leaders of each party have not hesitated to distort and manipulate statistics to suit their respective ends. Yet, taken from the arena of conflict, the question is a simple one. If by any means you can

neutralise or abolish a certain number of foci of contagion you must diminish the incidence of the disease, provided the measures you take do not increase the number of those who expose themselves to the contagion. Whether the measures adopted tend in this direction or not we can never know, as those from whom alone we can obtain direct information are biased and unreliable witnesses.

It seems strange, however, that the plan of "officers lecturing to the men and having discussions on this subject" should be suggested in a Christian community, where the advice of St. Paul is still supposed to carry weight—

"But fornication, and all uncleanness, or covetousness, let it not be once named among you as becometh saints";

"For it is a shame even to speak of those things which are done of them in secret."—Ephesians chap. v.

I am, dear Sir,

Yours truly,

"ULTIMA THULE."

TRYPANOSOMIASIS AT THE SOUTH END OF THE LAKE.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

DEAR COLONEL BRUCE,—I send you the following correspondence, which it might be well to publish. The information was sought for on account of the statement made by Sir Patrick Manson, at the recent discussion on Trypanosomiasis at the B.M.A. Meeting in July, 1904. It was to the effect that Trypanosomiasis was prevalent at the south end of Lake Victoria, but that no cases of Sleeping Sickness had occurred. This fact was considered an objection to accepting the view that *Trypanosoma gambiense* is the sole cause of Sleeping Sickness. It will be seen from a perusal of Dr. Ahlbory's letter that he has only met with one case of Trypanosomiasis. In view of the importance of the statement, it would be of interest to ascertain the source of Sir Patrick's information on this subject.

Yours, &c.,

(Signed) E. D. W. GREIG.

"SLEEPING SICKNESS COMMISSION,

"ENTEBBE, UGANDA PROTECTORATE.

"September 22nd, 1904.

"DEAR SIR,—I should be much obliged if you could give me particulars on the following points:—

"(1) Do cases of Sleeping Sickness occur in your district; if so, when it first appeared there, and if numerous or not?

"(2) Do cases of Trypanosoma infection without marked signs of Sleeping Sickness occur; if so, are they numerous or not?

"(3) Is the Tsetse-fly of Uganda (*G. palpalis*) found in your district; if so, (*a*) the locality; (*b*) the character of country in which found, *e.g.*, in bush, open place, swamp, papyrus, &c.

"(4) Any other information on this subject.

"I am very anxious to get exact facts regarding these points in your

district. Dr. Lott, who was stationed at Muanza, very kindly promised to obtain the information for me, but he is, I believe, on leave at present.

"Thanking you in advance, &c., &c., &c.

"(Signed) E. D. W. GREIG.

"DR. AHLBORY,
"*Muanza, German East Africa.*"

"MUANZA, November 9th, 1904.

"MUCH HONOURED COLLEAGUE,—I have the honour to give you the required information regarding Sleeping Sickness in the district of Muanza:—

"(1) Cases of Sleeping Sickness occurred formerly on the Gori River; since the recent survey this lies in English territory, so you will be able to find out about it. An imported case from Uganda occurred in Muanza.

"(2) In a boy, two years of age, I found trypanosomes in the blood. He was apparently healthy. The boy was born in Tabora, and his relatives say he has never left Unyamwezi and Ussukuma. One would therefore conclude that the transmitter of the trypanosomes is on the road between Muanza and Tabora.

"(3) *G. palpalis* has been found at the Gori River only. There it occurs in thick bush. The south coast of the lake has not been searched yet.

"(4) In the above-mentioned case of Sleeping Sickness from Uganda, I found numerous filaria in the blood; trypanosomes were not found. The cerebro-spinal fluid I did not investigate.

"(Signed) STABSARTZ AHLBORY.

"CAPT. GREIG, I.M.S.,
"*Entebbe.*"

JOURNAL

OF THE

ROYAL ARMY MEDICAL CORPS.

Corps News.

January, 1905.

Royal Army Medical Corps.

The undermentioned Majors are placed on retired pay. Dated November 16, 1904:—A. E. C. Spence, M.B.; C. J. Holmes, M.D.

Major Spence entered the Service August 2, 1884, and was promoted Surgeon-Major, August 2, 1896. His war services are as follows:—Soudan Expedition, 1885, Suakin, Medal with clasp, bronze star. Operations on the Nile, 1889. Operations on the N.W. Frontier of India, 1897-8. Operations on the Samana Range and in the Kurram Valley and of Flying Column Kohat Field Force. Also served with Tirah Expeditionary Force. Despatches, *London Gazette*, June 7, 1898. Medal with three clasps. South African War, 1901-2. Operations in Orange River Colony, June, 1901, to May 31, 1902. Operations in Cape Colony in June, 1901. Queen's medal with two clasps.

Major Holmes entered the Service August 2, 1884; and was promoted Surgeon-Major, August 2, 1896. His war services are as follows: Soudan Expedition, 1885, Suakin, Medal with clasp, bronze star. Expedition to Dongola, 1896. Operations of September 19, Egyptain medal with clasp. Medal, South African War, 1900-02. Operations in Cape Colony, September to October, 1900. Operations in Orange River Colony, November 30, 1900, to May, 1902. Queen's medal with clasp. King's medal with two clasps.

Captain M. H. G. Fell, from the seconded list, to be Captain. Dated October 21, 1904.

Army Medical Reserve of Officers.

Surgeon-Major C. Godson, M.D., to be Surgeon-Lieutenant-Colonel. Dated November 8, 1904.

Surgeon-Lieutenant A. Y. Greenwood, M.B., 3rd Lancashire Royal Garrison Artillery Volunteers, to be Surgeon-Lieutenant. Dated November 26, 1904.

Surgeon-Captain R. Mitchell, M.D., to be Surgeon-Major. Dated November 19, 1904.

Surgeon-Lieutenant A. H. L. Stewart, to be Surgeon-Captain. Dated November 22, 1904.

Surgeon-Lieutenant A. Robinson, M.D., 2nd Volunteer Battalion, York and Lancaster Regiment, to be Surgeon-Lieutenant. Dated December 7, 1904.

Royal Army Medical Corps (Militia).

Frederick Edward Bissell, M.D., to be Lieutenant. Dated December 3, 1904.

Imperial Yeomanry.

Denbighshire (Hussars).—Richard Geoffrey Williams, Gent., to be Surgeon-Lieutenant. Dated November 26, 1904.

Lincolnshire.—Major Thomas Horrocks Openshaw, M.B., F.R.C.S., C.M.G., from the London Companies, Royal Army Medical Corps (Volunteers), to be Surgeon-Major. Dated December 3, 1904.

Middlesex (Duke of Cambridge's Hussars).—Herbert Meggitt, Gent., to be extra Surgeon-Lieutenant, under paragraph 30, Yeomanry Regulations. Dated November 26, 1904.

Royal Army Medical Corps (Volunteers).

The Woolwich Companies.—Quartermaster W. T. Lomax to be Transport Officer. Dated November 19, 1904. James Stratton Warrack, M.D., to be Lieutenant. Dated November 19, 1904.

The Manchester Companies.—Quartermaster J. Lawrence resigns his Commission. Dated November 26, 1904.

The London Companies.—The undermentioned Captains resign their Commissions: C. H. Gage-Brown, M.D. Dated December 3, 1904. H. Fulham-Turner. Dated December 3, 1904.

Argyll and Sutherland Bearer Companies.—Brownlow Riddell, M.D., to be Lieutenant. Dated December 3, 1904.

South Yorkshire Bearer Company.—Louis Alexander French, Gent., to be Lieutenant. Dated December 3, 1904.

The Glasgow Companies.—Lieutenant J. Bruce, M.B., to be Captain. Dated December 10, 1904. Quartermaster W. Lee is granted the honorary rank of Captain. Dated December 10, 1904.

Lancashire Fusilier Bearer Company.—Surgeon-Captain R. Mitchell, M.D., to be Surgeon-Major. Dated December 10, 1904.

VOLUNTEER CORPS.

1*st Cumberland Royal Garrison Artillery* (*Volunteers*).—The undermentioned Medical Officers resign their Commissions: Surgeon-Major J. H. Dickson, M.B. Dated November 19, 1904. Surgeon-Captain R. L. Clark, M.B. Dated November 19, 1904.

The Queen's Volunteer Brigade, the Royal Scots (*Lothian Regiment*).—Lieutenant J. B. Jamieson resigns his Commission, and is appointed Surgeon-Lieutenant. Dated November 19, 1904.

1*st Volunteer Battalion, the Hampshire Regiment.*—Surgeon-Captain H. M. Brownfield is borne as Supernumerary whilst commanding the Hampshire Volunteer Infantry Brigade (*Bearer Company*). Dated November 19, 1904.

3*rd* (*The Blythswood*) *Volunteer Battalion, the Highland Light Infantry.*—Surgeon-Captain J. W. Loggie, M.B., resigns his Commission. Dated November 19, 1904.

4*th* (*Stirlingshire*) *Volunteer Battalion, Princess Louise's* (*Argyll and Sutherland Highlanders*).—Surgeon-Major A. D. Fraser, M.D., to be Surgeon-Lieutenant-Colonel. Dated November 19, 1904.

2*nd Durham* (*Seaham*), *R.G.A.*—Alfred Augustus Beeks, Gent., to be Surgeon-Lieutenant. Dated November 26, 1904.

4*th Volunteer Battalion, the King's* (*Liverpool Regiment*).—Surgeon-Lieutenant E. L. Hughes resigns his Commission. Dated November 26, 1904.

1*st Forfarshire, Royal Garrison Artillery* (*Volunteers*).—Surgeon-Captain D. M. Greig, M.B., to be Surgeon-Major. Dated December 3, 1904.

1*st Hampshire, Royal Garrison Artillery* (*Volunteers*).—Surgeon-Lieutenant A. A. MacKeith, M.B., to be Surgeon-Captain. Dated December 3, 1904.

The Queen's Rifle Volunteer Brigade, the Royal Scots (*Lothian Regiment*).—John Dixon Comrie, Gent., to be Surgeon-Lieutenant. Dated December 3, 1904.

21*st Middlesex* (*the Finsbury*).—Brigade-Surgeon-Lieutenant-Colonel J. Adams, Senior Medical Officer, 5th London Volunteer Infantry Brigade, is granted the honorary rank of Surgeon-Colonel. Dated December 3, 1904.

1*st London.*—Brigade-Surgeon-Lieutenant-Colonel W. R. Smith, M.D., Senior Medical Officer, 4th London Volunteer Infantry Brigade, is granted the honorary rank of Surgeon-Colonel. Dated December 3, 1904.

4*th London.*—Surgeon-Lieutenant F. J. P. Daly resigns his Commission. Dated December 3, 1904.

1*st Volunteer Battalion, the Durham Light Infantry.*—The undermentioned Officers are granted the honorary rank of Surgeon-Colonel: Brigade-Surgeon-Lieutenant-Colonel J. W. Blandford. Dated December 3, 1904. Surgeon-Lieutenant-Colonel G. Middlemiss, M.D. Dated December 3, 1904.

1*st Volunteer Battalion, the Highland Light Infantry.*—Surgeon-Lieutenant J. F. Findlay, M.B., resigns his Commission. Dated December 3, 1904.

15*th Middlesex* (*The Customs and the Docks*).—Surgeon-Lieutenant-Colonel F. W. Humphreys is granted the honorary rank of Surgeon-Colonel. Dated December 3, 1904.

1*st Lanarkshire, Royal Garrison Artillery* (*Volunteers*).—Surgeon-Lieutenant-Colonel J. Provan, M.D., retires under paragraph 103, Volunteer Regulations, and is granted the honorary rank of Surgeon-Colonel, with permission to wear the prescribed uniform. Dated December 10, 1904.

3*rd Volunteer Battalion, the Royal Fusiliers* (*City of London Regiment*).—Surgeon-Lieutenant J. A. Angus, to be Surgeon-Captain. Dated December 10, 1904.

1*st Cornwall* (*Duke of Cornwall's*), *Royal Garrison Artillery* (*Volunteers*).—Surgeon-Captain R. G. Nesbitt to be Surgeon-Major. Dated December 10, 1904.

4*th Volunteer Battalion, the Royal Fusiliers* (*City of London Regiment*).—Supernumerary Surgeon-Major (Brigade-Surgeon-Lieutenant-Colonel) W. D. Waterhouse

(Senior Medical Officer, 2nd London Volunteer Infantry Brigade) to be Surgeon-Lieutenant Colonel. Dated December 10, 1904.

2nd Volunteer Battalion, the Loyal North Lancashire Regiment.—Surgeon-Lieutenant F. Robinson resigns his Commission, and is appointed Second Lieutenant. Dated December 10, 1904.

13th Middlesex (*Queen's Westminster*).—The undermentioned Medical Officers resign their Commissions: Surgeon-Captain B. L. Stivens, M.D. Dated December 10, 1904. Surgeon-Captain J. S. Hudson. Dated December 10, 1904.

18th Middlesex.—Surgeon-Major C. Godson, M.D., to be Surgeon-Lieutenant-Colonel. Dated December 10, 1904.

THE VOLUNTEER OFFICER'S DECORATION.

The King has been graciously pleased to confer the Volunteer Officer's Decoration upon the undermentioned Medical Officers of the Volunteer Force, who have been duly recommended for the same under the terms of the Royal Warrant, dated July 25, 1892:—

2nd Middlesex Royal Garrison Artillery (*Volunteers*).—Surgeon-Captain (Honorary Captain in the Army) Atwood Thorne, M.B.

3rd (*Duke of Connaught's Own*) *Volunteer Battalion, the Hampshire Regiment.*—Brigade-Surgeon-Lieutenant-Colonel Edwin John Hunter.

3rd Volunteer Battalion, The South Wales Borderers.—Surgeon-Lieutenant-Colonel James Rolands Essex.

3rd (*Cambridgeshire*) *Volunteer Battalion, The Suffolk Regiment.*—Surgeon-Lieutenant-Colonel John Parkinson Atkinson, M.D.

1st Volunteer Battalion, The Manchester Regiment.—Surgeon-Lieutenant-Colonel William Mitchell Roocroft.

4th (*Stirlingshire*) *Volunteer Battalion, Princess Louise's* (*Argyll and Sutherland Highlanders*).—Surgeon-Major Alexander Duncan Fraser, M.D.

ARRIVALS HOME.—From India: Lieutenant-Colonels R. H. Forman, H. O. Trevor, J. G. Harwood; Majors E. S. Marder, G. T. Rawnsley, J. H. Brannigan, T. H. Corkery, J. Thomson, R. J. D. Hall, and B. F. Zimmermann; Captains S. A. Archer, J. Cowan, J. Poe, G. M. Goldsmith, B. F. Wingate, P. H. Falkner, P. McKessack, R. Selby, J. J. W. Prescott, D.S.O., A. Chopping, J. W. Langstaff, and N. H. Ross. From Barbados: Lieutenant-Colonel E. O. Milward and Captain H. J. McGrigor.

ARRIVALS HOME ON LEAVE.—Captains W. S. Crosthwait, L. W. Harrison, and W. L. Steel.

EMBARKATIONS.—For India: Colonel F. J. Williamson, C.B., C.M.G.; Lieutenant-Colonels E. H. L. Lynden-Bell, and W. W. Pike, D.S.O.; Majors P. C. H. Gordon, H. M. Adamson, H. A. Cummins, C.M.G., H. Cocks, T. McDermott, G. Scott, H. D. Mason, A. Kennedy, W. S. Bowman, E. A. Burnside, G. M. Dobson, and R. C. Thacker; Captains W. E. Hudleston, J. G. Berne, and W. M. H. Spiller; Lieutenants F. J. Turner, S. L. Pallant, W. MacD. MacDowall, A. B. Smallman, D. P. Johnstone, C. R. Bradley, and A. A. Meaden. For Gibraltar: Lieutenant-Colonel D. V. O'Connell, and Captain H. A. Berryman. For Malta: Captain A. E. Master. For Uganda: F. M. G. Tulloch. For West Africa: Captains H. W. Grattan, and A. W. Sampey.

EXCHANGES.—The following exchanges on the Roster have been permitted:—
Lieutenant-Colonel D. V. O'Connell with Lieutenant-Colonel A. Dodd.
Lieutenant-Colonel C. W. S. Magrath with Major F. W. G. Hall.
Captain J. S. Gallie with Captain C. H. Hopkins.

POSTING.—Lieutenant-Colonels H. O. Trevor, H. J. R. Moberly, and Captain B. F. Wingate to Aldershot. Lieutenant-Colonel R. P. Hetherington, Major R. J. D. Hall, Captains S. A. Archer, J. Poe, G. M. Goldsmith, and P. H. Falkner, to Ireland. Major J. H. Brannigan to York. Majors B. F. Zimmermann and G. T. Rawnsley to Southern District. Captain J. Cowan to Netley. Major E. S. Marder and Captain N. H. Ross to Dover. Captains H. J. McGrigor and R. Selby to Woolwich. Major T. H. Corkery, Captains P. MacKessack and J. J. W. Prescott, D.S.O., to Devonport. Major J. Thompson to Edinburgh. Captain J. W. Langstaff to Chester. Captain A. Chopping to Home District. Captain R. L. Argles to Salisbury Plain District.

Lieutenant-Colonel E. O. Milward to Southampton as Embarking Medical Officer.

CHANGES OF STATION.—Lieutenant-Colonel H. K. Allport from Thames District

to Salisbury Plain District. Lieutenant-Colonel S. F. Freyer, C.M.G., from Home District to Aldershot. Major C. E. Pollock from Home District to Woolwich District.

Lieutenant H. B. Connell has been selected for service under the Foreign Office.

Lieutenant R. L. V. Foster has been selected for service with the Egyptian Army.

Lieutenant F. M. G. Tulloch has proceeded to Uganda for Special Duty under the Foreign Office.

ROYAL ARMY MEDICAL CORPS.

LIST OF CASUALTIES, &c.—From November 11 to December 10, 1904, inclusive.

Discharges.—5689 Sergeant-Major R. C. Rowan, to pension, November 15; 5413 Sergeant-Major A. Collins, to pension, December 5; 4923 Sergeant-Major J. J. Saunders, to pension, December 5; 4614 Sergeant-Major A. J. Wiseman, to pension. December 5; 11514 Lance-Corporal G. F. Ambrose, medically unfit, November 16; 7465 Private T. Sutcliffe, modified pension, November 7; 19298 Private E. E. Steel, purchase, December 7.

To Army Reserve.—11361 Corporal G. E. Letchford, December 7; 15657 Private W. Beck, November 12; 15618 Private T. Orritt, November 12; 15623 Private W. Ramsey, November 4; 15672 Private T. Standing, November 12; 15638 Private A. Meekums, November 12; 15615 Private H. Winkley, November 12; 16554 Private J. Stewart, November 14; 10115 Private A. F. Payne, November 21; 16747 Private S. Henderson, December 2: 16750 Private J. A. Wetton, December 2.

Transfers to other Corps.—19233 Private J. Bowen, 5th Lancers, November 19; 19227 Private C. W. Bunyon, 5th Lancers, November 30; 19196 Private W. A. Gregory, 8th Hussars, November 15; 19257 Private J. Evans, 8th Hussars, December 1; 19321 Private J. A. Smith, 8th Hussars, December 1; 19328 Private W. H. Buckler, 8th Hussars, December 1; 19348 Private A. A. Bishop, 8th Hussars, December 1; 17261 Private G. Steward, 11th Hussars, November 26; 19309 Private S. Hughes, Royal Horse Artillery, November 24; 19172 Private J. D. Drysdale, Royal Field Artillery, November 15; 19278 Private E. L. Kirk, Royal Field Artillery, November 13; 19325 Private M. J. Campbell, Royal Garrison Artillery, November 12; 19100 Private J. Mills, Gordon Highlanders, November 12.

Embarkations.—10892 Sergeant H. J. Reeve, to Sierra Leone, per s.s. "Oron," November 30.

Disembarkations.—From Bermuda, ex s.s. "Mongolion," November 27: 11714 Sergeant E. Kerstein; 12652 Private A. E. Burrows; 11811 Private L. H. Chapman.

From Jamaica ex R.M.S. "Trent," December 1: 18131 Lance-Corporal W. Greenhalgh; 18970 Private J. Higginbotham.

From Egypt, ex s.s. "Dunera," 8453 Sergeant J. W. Matthews; 10581 Sergeant H. Warsop; 10211 Sergeant J. E. Dougherty; 16227 Corporal J. Asworth; 9626 Private S. Neale; 17548 Private H. Carter; 18564 Private D. Campbell; 17635 Private D. Field; 16032 Private W. MacLaren; 18951 Private F. Moss; 18987 Private G. J. Tanner; 9735 Private J. A. Snell.

From Malta, ex s.s. "Dunera": 15722 Private G. F. Pinkney; 17605 Private H. J. Rush; 17669 Private J. T. Rayner; 17563 Private J. Stanton.

From South Africa, ex s.s. "Durham Castle": 6583 Quartermaster-Sergeant J. Carter.

QUEEN ALEXANDRA'S IMPERIAL MILITARY NURSING SERVICE:—

Appointments.—To be Staff-Nurses:—Miss K. A. Allsop, posted to Aldershot; Miss M. Clements, posted to Colchester; Miss K. Coxon, posted to Aldershot; Miss L. Cunningham, posted to Woolwich; Miss S. N. Daly, posted to Hounslow; Miss H. Hare, posted to Colchester; Miss H. L. A. Jack, posted to Alton; Miss D. Michell, posted to Colchester; Miss J. Murphy, posted to Colchester; Miss V. G. Paschali, posted to Chatham; Miss B. Rankin, posted to Colchester; Miss A. Rowe, posted to Portsmouth; Miss F. St. Quintin, posted to Aldershot; Miss P. Steele, posted to Royal Military College, Sandhurst; Miss L. Strickland, posted to Aldershot; Miss E. M. Walby, posted to Chatham.

Appointments Confirmed.—Staff-Nurses: Miss L. M. Moor, Miss M. E. Richardson, Miss A. M. Pagan.

Promotions.—The undermentioned Staff-Nurses to be Sisters: Miss M. L. Harris, Miss K. M. Hewetson, Miss L. E. Mackay, Miss E. S. Mason, Miss M. Walker.

Changes of Station:—

Matrons: Miss L. Hardement to Chatham; Miss M. C. S. Knox, R.R.C., Dover to

South Africa; Miss C. H. Potts, Curragh to South Africa; Miss H. W. Reid, Wynberg to Pretoria.

Sisters: Miss E. Beck, York to South Africa; Miss E. H. Hay, Alton to Colchester; Miss L. M. Lyall, Woolwich to South Africa; Miss E. S. Mason, Aldershot to Colchester; Miss R. Osborne, Alton to South Africa; Miss K. Pearse, Aldershot to Chatham; Miss C. K. E. Steel, Aldershot to London; Miss E. C. Stewart, Aldershot to South Africa.

NOTES FROM THE HOME DISTRICT.—Captain J. I. W. Morris, R.A.M.C., joined for duty on December 12th.

An exchange of Stations has been sanctioned between Major Girvin, of Guildford, and Major E. McK. Williams, of London, with effect from January 1.

Sergeant-Major Green proceeds to Portsmouth for duty from Rochester Row, and Sergeant-Major Hayward joins from Portsmouth for duty at Rochester Row.

Staff-Sergeant Fells rejoins the Headquarters of the Company from the permanent staff of the Volunteers.

Sergeant Elliott joins the Depôt, Aldershot, previous to embarking for South Africa for a tour of duty.

NOTES FROM MAURITIUS.—Major N. Manders, Captain H. E. Staddon, Sergeants Conolly and Angell, Corporals Hughes and Rolfe, and Privates Allen and Church, arrived for duty on November 7, 1904. Captain H. F. Shea, Staff-Sergeant Thomas, Corporal Jones, Lance-Corporal Colville, Privates Soper, Palmer, and Yorke, tour of service completed, embark on or about November 22, for passage to England. Captain T. C. Mackenzie, D.S.O., at present on sick leave, has been struck off the strength of the Command. Major Manders has assumed charge of the Station Hospital, Curepipe, and Captain Staddon of the Detention Hospital at Vacoas, also medical charge of Effective European Troops at that Station.

His Majesty's birthday was kept up in the usual way at this Station; the detachment of the Corps stationed at the headquarters (Curepipe) paraded under the Command of Captain Stammers, and formed up on the left of the detachment 1st Northumberland Fusiliers, the whole parade being under the Command of Major Enderby, 1st Northumberland Fusiliers.

The season for the Military Football League was brought to a close on November 9, when the winners ("F" Company Northumberland Fusiliers) played a match with a team selected from the remainder of the League (Private Fielding, as right half back, represented the Corps on this occasion); the "remainder" team won by one goal to nil. After the match the General Officer Commanding (Brigadier-General C. T. E. Metcalfe, C.B.) presented the League winners with the Shield (given by Colonel North, R.A.M.C.), and gold and silver medals. The General, in a few remarks, thanked Colonel North for giving such a handsome shield for competition, complimented the players on their success, thanked the Committee for their exertions towards sport, and wished the League the same success next year. Cheers were then given for the General, which brought the proceedings to a close.

NOTES FROM NETLEY.—Major A. J. Chambers and Captain H. C. R. Hime have arrived for duty, and the former has taken over medical charge of Female Hospital, Staff and Families.

A very successful dance was given by Sir E. Townsend and the Officers of the Corps on November 25. Over 250 guests were present, and a good programme was excellently rendered by the Corps Band, under the able bâton of Mr. Bennett.

We have to thank Aldershot for a goodly contingent of bachelors, in fact their presence, and that of many other dancing men, made the evening pleasant from the ladies' point of view.

"The King" was played about 4 a.m. and it was thought by all concerned that we had improved on the former dance, given on May 27 last.

NOTES FROM QUETTA, BALOOCHISTAN.—Lieutenant N. Dunbar Walker, R.A.M.C., writes: "Since last writing there have been few changes. Major Pocock has left, tour expired, and his place in the Dental Surgery has been taken by Captain Williamson. Major Blackwell has joined us from Netley, and has taken over the District Laboratory from Captain Furnivall, who is under orders for Aden.

"Two efforts for raising money to furnish the officers' wards in the Station Hospital with furniture have lately been made, the first was a Pagal Gymkhana, got up by Lieutenant-Colonel Donnet, and the second was an evening entertainment at the Club, got up by several ladies in the Station, comprising tableaux, and a musical programme.

ROYAL ARMY MEDICAL CORPS JOURNAL TRADING ACCOUNT.

Dr. FROM JULY 1, 1903, TO JUNE 30, 1904. Cr.

	£	s.	d.
To Government Grant	200	0	0
1,101 Subscribers at £1	1,101	0	0
Advertisements	181	0	0
Sales	33	1	5
Reprints	7	14	3
Sundries	0	17	3

		£ s. d.	£ s. d.	£ s. d.
From July 1, 1903, to June 30, 1904.	By Messrs. Bale's Accounts for issue of the Journal, from July, 1903, to June, 1904, inclusive, as per detailed statement attached—			
	To 19,750 Copies of the Journal, R.A.M.C.		700 14 3	
	Printing Extras for Small Type, &c.		73 17 3	
	Corrections		25 1 0	
	Blocks, Drawings, &c.		108 3 6	
	Plates		33 14 6	
	Envelopes, Fasteners, &c.		37 2 0	
	Addressing, Banding, and Stamping		7 12 3	
	Postage		85 13 8	
	Letter Heads, Note Heads, &c.		2 9 0	
	Circulars		1 8 6	
	Subscription forms		2 2 0	
	Complimentary Note Forms		0 5 6	
	Dummies		0 7 0	
	Receipt Books		0 15 0	
	Packing and Parcels		1 17 7	
	Index		4 12 6	
	Binding		1 0 6	
	Rubber Stamps		0 8 0	
	Sundries		1 11 6	
	Reprints		4 3 6	
				1,092 19 0
1903. July	Cheque, Lieut.-Col. Wilson		0 10 0	
,,	,, Major R. H. Firth		1 13 0	
,,	Refund, Surg-General Muir		1 0 0	
June	Cheque Book		0 4 2	
,,	Exchange on Drafts		0 8 0	
Aug.	Cheque, W. Gillham (Typewriting)		1 12 6	
Sept.	Cheque, Messrs. Godart and Co. (Typewriting)		3 3 0	
,,	Cheque, M. H. Donaldson (Typewriting)		1 6 3	
Oct.	Cheque, Lieut.-Colonel R. H. Firth, in payment of—			
	Miss Delf	5 0 0		
	Dr. Connor	4 3 0		
	Dr. Handson	4 4 6		
			13 7 6	

Date	Particulars	£ s. d.	£ s. d.
Oct.	Cheque, W. Gillham (Typewriting)	1 6 0	
,,	Exchange on Drafts	0 3 6	
Nov.	Cheque, W. Gillham (Typewriting)	1 17 6	
Dec.	Cheque, Lieut.-Col. R. H. Firth	10 9 3	
,,	,, W. Gillham (Typewriting)	0 8 1	
1904.			
Jan.	Cheque, Col. Bruce } Book case, Book wagons, &c., &c.	3 15 0	
,,	,, ,,	2 2 0	
Feb.	,, ,,	5 6 6	
,,	Remington Typewriter	20 7 6	
May	Cheque, A. G. Engel Terzi (Plates)	10 10 0	
June	Addressograph	32 9 11	
,,	Exchange on Drafts	0 7 6	
,,	Bank Postages	0 8 0	
			112 15 2
	Contingent Account		50 0 0
			£1,255 14 2
	Balance, Cr.		267 18 9
		£1,523 12 11	£1,523 12 11

Examined and found correct, this 8th day of October, 1904.

The bank book, and vouchers for receipts and expenditure have been examined by us, and found to tally with the statement of accounts.

October 7th, 1904.

(*Signed*) H. E. R. JAMES, *Colonel*.
R. H. FIRTH, *Lieut.-Colonel*. } *Auditing Officers.*

CONTINGENT ACCOUNT.

Dr.	£ s. d.	Cr.	£ s. d.
To Cheques, Major T. McCulloch	50 0 0	By Clerk's Wages	37 15 0
		Account Books, Stationery, &c.	0 19 $5\frac{1}{2}$
		Postage	5 6 7
		Cab, 'Bus, and Messenger	1 3 6
		Advertisements	0 18 0
			£46 2 $6\frac{1}{2}$
		Balance in hand	3 17 $5\frac{1}{2}$
	£50 0 0		£50 0 0

Winter is upon us, and there have been slight falls of snow in the neighbouring hills, our winter game of golf is in full swing, and six of our staff of seven are players. We were 'at home' on the last day of the Autumn Race Meeting.

"Our Principal Medical Officer, Colonel T. S. Weir, I.M.S., is away on leave, and Lieutenant-Colonel Lees Hall, R.A.M.C., is acting.

"The Principal Medical Officer of our Command paid us a visit last week."

THE ROYAL ARMY MEDICAL CORPS FUND.

The Fifteenth Meeting of the Committee.

The fifteenth meeting of the Committee was held at 68, Victoria Street, S.W., on Tuesday, November 29, 1904, at 4.30 p.m.

Present:

Surgeon-General H. Skey Muir, C.B., in the Chair.
Lieutenant-Colonel E. Fairland.
Lieutenant-Colonel J. F. Beattie.
Surgeon-General A. H. Keogh, C.B.
Surgeon-General W. H. McNamara, C.B., C.M.G.
Colonel A. T. Sloggett, C.M.G.
Colonel H. E. R. James.
Major H. C. Thurston, C.M.G.
Lieutenant-Colonel R. H. Firth.
Captain G. St. C. Thom.

(1) The Minutes of the fourteenth Meeting were confirmed.

(2) With reference to Minute seven of the last meeting, the Committee noted that Mrs. Forrest had left to the discretion of the Committee the allocation of the balance of the Forrest Memorial Fund.

(3) Colonel James pointed out the desirability of having the three "V.C." pictures framed temporarily, pending the completion of the Royal Army Medical College. On the proposal of Lieutenant-Colonel Firth, seconded by Colonel Sloggett, this was agreed to, at a cost not to exceed 10s. per picture.

(4) At the request of the Principal Medical Officer, Netley, Lieutenant-Colonel Twiss reported, for the information of the Committee, that the Crimean War Memorial at the Royal Victoria Hospital, is in need of renovation. Information is not yet available as to the exact amount of repair necessary.

Surgeon-General Keogh offered to make an arrangement with an expert to report on the condition of the memorial, and to state what he might consider the best steps to be taken to place it in a satisfactory condition. The Committee agreed to Surgeon-General Keogh's proposal, and postponed further consideration of the matter until it was in possession of sufficient information.

(5) Periodic payments for the maintenance of children at charitable schools are being carried out through the Principal Medical Officers of the districts in which the parents reside.

The Committee is of opinion that it is desirable to continue this procedure, as it enables the Principal Medical Officers to keep in touch with the children concerned.

(6) Colonel James laid before the Committee the case of No. 1154, Corporal G. F. A., who was invalided from the service with tubercle. He is in receipt of 2s. 6d a day pension. Colonel James stated that it was desirable that Corpora A. should be admitted into a home for the treatment of tubercle, and pointed out that at the Victoria Hospital for Consumption, Edinburgh, the cost of maintenance and treatment for such cases is £1 1s. per week. He strongly recommended the case to the Committee for consideration. Surgeon-General Keogh seconded this recommendation.

The Committee unanimously resolved to devote the sum of £10 from the General Relief Fund towards the maintenance of Corporal A. at the above institution for a period of four months, the pensioner himself contributing the balance requisite for his support. Colonel James promised to make the necessary arrangements forthwith.

B. Skinner, *Lieutenant-Colonel,*
Hon. Secretary.

November 30, 1904.

R.A.M.C.(V.) LEEDS COMPANY.

ANNUAL DINNER.

THE Leeds Volunteer Company of the Royal Army Medical Corps held their seventeenth annual dinner at the Grand Central Hotel, when there was a strong muster of members and guests of the Corps.

The Commanding Officer (Major De Burgh Birch) presided, and among those present were Lieutenant Wear, Lieutenant Robson, Lieutenant Young, and Honorary Captain-Quartermaster Gardner, of the Company: Brigade-Surgeon Lieutenant-Colonel Lee, of Dewsbury; Captain Bullock, Captain McPherson, and Lieutenant Peel, of the Leeds Artillery Volunteers; Surgeon-Captain Waite, of the Leeds Engineers; Dr. Trevelyan, Dr. Pearson, Superintendent of the Leeds Infectious Diseases Hospitals, Mr. Walter Thompson, Mr. Atter, Mr. T. Sanders, and Mr. F. Sherburn.

After the loyal toast had been proposed in suitable terms by the chairman, and duly honoured, Lieutenant Wear proposed the toast of "The Visitors." In doing so, he said they might congratulate themselves upon the fact that for the first time in its history the *personnel* of the Corps was quite complete. He coupled with the toast the names of Lieutenant-Colonel Lee and Staff-Sergeant Fitz, of the R.A.M.C.

Lieutenant-Colonel Lee, responding to the toast, which was received with musical honours, said that in England we were passing through what might become a crisis in regard to the differences with Russia, and the eyes of the country were turned on the war in the Far East. Relating some interesting reminiscences of a visit to Japan, Lieutenant-Colonel Lee went on to say that the points about the Japanese which struck every one were their adaptability and their earnestness. He had noticed the readiness with which they were prepared to pick the brains of the West. They did not imitate blindly but sifted the evidence for themselves, and he remembered being particularly struck by the signs he saw of the great progress the Japanese had made, and the great knowledge they had acquired in medical and surgical work. They had sent representatives to all the leading countries of the West, and had picked up the best that was to be found.

Staff-Sergeant Fitz also responded suitably, and the remainder of the evening was devoted to the enjoyment of a lengthy and varied musical programme.

R.A.M.C. COLOURS COMMITTEE.

A MEETING of the Colours Committee was held at 68, Victoria Street, on December 13, 1904:—

Present: Colonel A. T. Sloggett, C.M.G., in the Chair, Colonel H. E. R. James, Lieutenant-Colonel M. O'D. Braddell, Lieutenant-Colonel H. N. Thompson, D.S.O.

Two patterns were selected, and it was proposed by Colonel Sloggett, seconded by Colonel James and carried unanimously, that these two, together with a pattern of the colours at present in use, should be sent to every Principal Medical Officer, both at home and abroad, in order that a consensus of the opinions of all officers of the corps, as far as possible, should be arrived at before coming to a final decision. The results will be notified at the next general meeting in June, 1905.

ENNO SANDER PRIZES.

LIEUTENANT-COLONEL HATHAWAY, R.A.M.C., has been awarded the Enno Sander second prize for his essay on "The Relation of the Medical Department to the Health of Armies." Both First and Second Prizes have been won by members of the Royal Army Medical Corps for the year 1904.

ROYAL COLLEGE OF SURGEONS IN IRELAND.

THE following extract is taken from the *British Medical Journal*, dated December 3, 1904, p. 1549.

FELLOWSHIP EXAMINATION.

The following candidates having passed the necessary examination, have been admitted Fellows of the College: "K. B. Barnett, B.Ch., &c., Royal University, Ireland, Captain, Royal Army Medical Corps." . . . .

ROYAL ARMY MEDICAL COLLEGE MESS.

The accompanying photograph is of a clock, presented by No. XX. General Hospital, Elandsfontein, to the Royal Army Medical College Mess, and was the first gift made by officers of the Corps to the Mess upon the establishment of the College in London.

It is of an artistic (Italian) design, and stands fifteen inches high. The face is of frosted silver, and the setting of carved rosewood.

PRESENTATION OF KING'S COLOUR.

At a Royal Review of the Metropolitan Troops of the Commonwealth Military Forces of Victoria, held upon November 14, 1904, in honour of His Majesty's birthday, a King's Colour was presented to the Australian Army Medical Corps. Upon the staff of the Colour the undermentioned inscription appears on a silver shield:—

"Presented by His Most Gracious Majesty the King Emperor, to the Australian Army Medical Corps, in recognition of services rendered to the Empire in South Africa, 1904."

BIRTHS.

FUHR—At Sialkot, Punjab, India, the wife of Captain R. H. Fuhr, D.S.O., R.A.M.C., —a son.

JONES.—On November 9, at 11, Elliot Street, The Hoe, Plymouth, the wife of Lieutenant-Colonel J. M. Jones, R.A.M.C., of a daughter.

MOBERLY.—On December 7, at 50, Sutherland Avenue, W., the wife of Lieutenant-Colonel H. J. R. Moberly, R.A.M.C., of a daughter.

MARRIAGES.

PATERSON—JACOB.—November 23, at St. Ann's Church, Dublin, by the Rev. J. Paterson Smyth, D.Litt., Vicar, assisted by the Rev. Cecil Patten, B.A., Rector of Fethard, Co. Tipperary, Ian Paterson, Major, Royal Army Medical Corps, son of John Paterson, Ard Rhu, Onich, Inverness-shire, to Amy Constance, daughter of the late Archibald Hamilton Jacob, M.D., T.C.D., F.R.C.S.I., of 23, Ely Place, Dublin.

TULLOCH—HUNTING.—On December 1, at Holy Trinity, Clapham Common, by the Rev. F. W. Metcalf, M.A., Vicar of St. Barnabas, Clapham Common, assisted by the Rev. W. Boyd, M.A., Vicar of All Saints, Norfolk Square, W., Forbes Manson Grant, R.A.M.C., youngest son of Surgeon-General Tulloch, of Balnoon, Eastbourne, formerly of the 11th North Devon, to Winifred Elizabeth Louise, eldest daughter of Charles S. Hunting, of Eachwick Hall, Northumberland.

DEATHS.

HOPWOOD.—On November 19, at Coylton, Bournemouth, Sarah Elizabeth (Sela), the dearly loved wife of Deputy Surgeon-General Hopwood (Ret.), A.M.D., aged 50.

NOTICE TO SUBSCRIBERS.

Officers are particularly requested to give timely notice of changes of station or changes of address, in order to ensure the posting of the Journal to its correct destination.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, &c. He will also be glad to receive items of news and information regarding matters of interest to the Corps from the various garrisons, districts and commands at home and abroad. All these communications should be written upon one side of the paper only, they should by preference be type-written, but, if not, all proper names should be written in capital letters (or printed) to avoid mistakes, and be addressed to the Editor, Journal of the Royal Army Medical Corps, 68, Victoria Street, London, S.W.

Letters regarding subscriptions, non-delivery of the Journal, or change of address, should be sent to Major T. McCulloch, R.A.M.C., 68, Victoria Street, London, S.W.

Communications have been received from Surgeon-General W. F. Stevenson, C.B.; Colonel H. E. R. James; Lieutenant-Colonels J. G. MacNeece, G. Coutts, A. B. Cottell (ret.), R. R. H. Moore, R. H. Firth, N. H. Forman; Majors C. J. Macdonald, J. W. Cockerill, E. Eckersley, P. G. Ievers (ret.), A. R. Aldridge, R. F. E. Austin; Surgeon-Major H. Raynor, R.H.G.; Captains L. F. Smith, R. Selby, R. H. Luce (Vol.), P. S. Lelean, R. T. Halliday (Vol.); Lieutenant A. B. Smallman; G. L. Cheatle, Esq., C.B.

In the event of reprints of articles being required by the authors, notification of such must be sent when submitting the papers. Reprints may be obtained at the following rates:—

	s. d.		s. d.		s. d.
25 Copies of 4 pp.	4 6	Of 8 pp.	7 6	Extra for covers	4 0
50 ,, ,,	5 6	,,	9 0	,,	5 0
100 ,, ,,	7 6	,,	12 6	,,	6 6
200 ,, ,,	11 6	,,	19 0	,,	9 0

Cases for Binding Volumes.—Strong and useful cases for binding can be obtained from the publishers at the undermentioned rates:—

Covers, 1*s.* 4*d.* net; binding, 1*s.* 2*d.*

These charges are exclusive of cost of Postage.

In forwarding parts for binding the name and address of sender should be enclosed in parcel.

The following periodicals have been received: *The Medical Record, The Medical News, New York Medical Journal, American Medicine, Gazette Med. de Paris, Archives de Medicine et de Pharmacie Militaires, Il Morgagni, Gazetta Medico-Italiana, The Medical Review, El Siglo Medico, Der Militärärzt, Deutsche Militärärztliche Zeitschrift, Anales de Sanidad Militar, Revue Med. de la Suisse Romande, La Medicina Militar Espanola, The Boston Medical and Surgical Journal, Annali di Med. Navale, Giornale del Regio Esercito, Le Caducée, The Hospital, The Ophthalmoscope, St. Thomas's Hospital Gazette, Bulletin de l'Acad. de Med. de Paris, Arch. Med. Belges, Voyenno Medisinskii, The Indian Medical Gazette, The Australasian Medical Gazette, Journal of the Association of Military Surgeons, U.S., Militärlagen ungivet af Militärlaegeforeningen,* i Kjobenharn, *The Veterinary Journal, The Practitioner, Public Health, Medical Review, Journal of Infectious Diseases, Chicago, The Army and Navy Gazette, The United Service Gazette, Journal of the Royal United Service Institution, The Johns Hopkins Press.*

We desire to remind members who paid their first year's subscription by cheque or postal order that the annual subscription is due on July 1, and it is very important that such should be promptly paid.

NOTICE.

The Corps News is now printed as an inset to the Journal and separate copies may be subscribed for, price 2d. monthly

VOLUME IV. FEBRUARY, 1905. No. 2.

Journal

of the

Royal Army Medical Corps.

Original Communications.

NOTES ON A SERIES OF OPERATIONS FOR THE EXTRACTION OF CATARACT.

By Captain D. J. COLLINS.
Royal Army Medical Corps.

THE series of cases on which these notes are based is a small one, comprising in all 36 cases. All the operations were performed in Poona, in 1901-2, and the majority in the Cantonment Hospital in that station. The cases were all amongst natives of India, four being Parsees, five Mahomedans, twenty-six Hindoos, and one a Goanese. Cataract in India appears to be far less common amongst the Mahomedans than it is amongst the Hindoo population ; in this series, the Hindoos represent 72 per cent. of the total, while the Mahomedans only show 14 per cent. The cause of this disproportion has yet to be explained, and it seems curious why one class should be more affected with cataract than another. It is worthy of notice, in this connection, that the Mahomedans as a class wear more headgear, in the shape of massive puggarees, than do the Hindoos, whose only protection from the tropical sun is frequently a mere rag ; and, also, there is the fact to be noted that the Mahomedans eat more animal food than the Hindoos, whose staple diet is of a vegetable nature. Whether these matters have any bearing on the subject or not is, of course, open to question, but the facts that cataract is more prevalent amongst the inhabitants of the tropical and sub-tropical countries of Asia than amongst the

races of the colder countries of Europe, and also that in India the Mahomedan race is proportionately less affected than the Hindoo, offer an interesting field of investigation and research.

The ages given by the patients were as follows, but it must be remembered that the average native of India is very vague about his correct age: 1 patient was 28; 4 were between 30 and 40; 9 between 41 and 50; 12 between 51 and 60; 8 between 61 and 70; and 2 between 71 and 80. Of the 36 cases, 9 were Morgagnian cataracts, 12 were nuclear, and 15 cortico-nuclear; 31 cases were successful, 4 unsuccessful, and 1 partially so.

The Technique of the Operation.—The preparation of the patient and of the eye to be operated on form a very important part of the procedure. I have found it of great advantage to have the patient under observation in hospital for a few days before the operation, in order that his general health may be attended to, and the condition of his urine investigated. A moderate degree of albuminuria is no bar to the success of the operation, but I should hesitate where the amount of albumen was large. One of the patients operated on had been suffering from diabetes for many years, the urine containing about 20 grains of sugar to the ounce; this case, however, did very well, and recovered as rapidly as those who were in perfect health. Another advantage of having the patients in hospital for a few days before operation is that they learn, by association with those who have been operated on, what they have to go through and what is expected from them later on. On the day before operation the patient is given a lotion of perchloride of mercury (1 in 5,000) and an eye-bath, and is instructed to bathe the eyes every four hours. A hot bath is given the evening before, and a purgative is also administered; on the morning of operation, the face and exterior of the eyelids are first thoroughly cleansed with soap and water, and then with perchloride of mercury lotion (1 in 2,000); next the lids are everted, and the lids, conjunctiva and canthi are irrigated with 1 in 5,000 perchloride solution, and finally a pad of gauze, soaked in this solution, is placed over the eye, and kept there by a bandage until the patient is on the operating table. When on the table, cocaine (2 per cent.) is instilled into both eyes, the lids of the eye to be operated on are again everted, and the conjunctival sacs irrigated with weak perchloride solution, and cocaine is again dropped into the eye, until it is fully anæsthetised.

The thorough cleansing of the fornices, and especially of the inner canthus, is most important, and any retained discharge or unhealthy secretion would seriously militate against the success of

the operation. In only one case, that of a very nervous woman, was it found necessary to administer a general anæsthetic; the patient was so very irritable and nervous, that she was quite unable to keep her eyes motionless under cocaine. I think, however, that a hypodermic injection of morphia, with cocaine dropped in the eye, would have been better, as under a general anæsthetic one loses the help which the patient is able to give by rotating the eyes in the required directions. In this particular case, the movements of the eye had to be controlled by a fixation forceps in the hands of an assistant, and this fact necessarily rendered the operation more complicated, and increased the risks.

A sclero-corneal incision, embracing about two-fifths of the circumference of the cornea, was employed in all the cases, the conjunctival flap, which is formed at the upper margin of the incision, being turned down on the cornea during the operation; union appears to take place more quickly if this conjunctival flap is made. It is advisable always to make a large incision, as considerable difficulty is experienced in delivering the lens if the incision is too small, and particles of cortical matter are liable to be left behind in the anterior chamber; these will then have to be removed piecemeal, with great risk of vitreous escaping, and subsequent irido-cyclitis. It is therefore much better to make the incision rather too large than to risk making one too small, with its attendant difficulties and dangers.

An iridectomy was performed in all cases except one. Opinion in India is much divided as to whether an iridectomy should be done or not, but it seems to me that the risk of injuring the iris, with resulting iritis, synechiæ, and perhaps prolapse of the vitreous, is much greater when cataract extraction is attempted without iridectomy. The case in which the extraction was done without an iridectomy was altogether unintentional on my part. The patient was a nervous man, who directly after the sclero-corneal incision had been made rolled his eyes violently. What appeared at first to be a very large cataract presented in the wound, and was delivered without difficulty; but on further examination it was found that the lens had been expelled with its capsule unruptured, the suspensory ligament of the lens having been torn by the violent contraction of the orbital muscles. Nothing further was done beyond instilling atropine, and the patient made an unusually rapid recovery.

The capsulotomy, or laceration of the lens capsule, requires considerable care, and a rather delicate touch. If too much pressure is employed in the process, the lens is liable to be dislocated into the vitreous chamber; while if the capsule is not torn freely enough,

the lens cannot be expressed, and the cystitome must be employed again. Delivery was effected by pressure with a spoon on the sclerotic and lower part of the cornea, counter-pressure being similarly made on the sclerotic above the incision. It is most important not to employ too much pressure in effecting delivery, this being one of the commonest causes of escape of the vitreous. Cortical *débris* should, as far as possible, be removed by gently stroking the cornea in an upward direction. After applying a cold compress and allowing a short interval for the aqueous humour to reform in the anterior chamber, I have found the "lid-manœuvre," described by Mr. Swanzy, most useful in getting rid of any remaining particles of cortical matter. The iris is then carefully replaced with a spatula, atropine instilled, and the dressing applied. In India, where a steriliser was not available, I have always employed for the dressing gauze boiled and soaked in 1 in 5,000 perchloride lotion, with a pad of wool and bandage over both eyes. This dressing was untouched for forty-eight hours, and subsequent dressings were done morning and evening. These consisted in gently washing the eye with weak perchloride lotion and dropping in atropine. In favourable cases the dressings were removed on the seventh to the tenth day, and dark glasses substituted. In six of these cases a small amount of vitreous escaped after delivery of the lens, but all did well afterwards. This accident is extremely likely to happen where the tension of the globe is at all raised, and all undue pressure on the eye must be carefully avoided during the operation. It would, however, appear that the loss of a small quantity of vitreous after delivery of the lens is not of serious import, and normal tension is soon recovered. In two cases, as a result of too great pressure during capsulotomy, the lens was dislocated backwards, and delivery had to be effected by means of a vectis. Hæmorrhage in the anterior chamber was noticed in three cases a few days after operation, probably the result of injury to the eye caused by the patients turning in bed during sleep, or perhaps due to a fit of coughing. The blood was gradually absorbed, leaving the pupil clear.

The four unsuccessful cases were the result of severe irido-cyclitis after operation. One of the patients was discharged from hospital, but returned after a week with irido-cyclitis, and vision was totally lost in the eye. In a few cases, tags of capsule remained stretching across the pupil, and needling was necessary to disperse them. As regards the resulting vision, the majority of the patients were unable to read, but had very fair distant vision when fitted with + 10 D. glasses, while those who were able to read required + 14 D. to + 17 D. lenses for that purpose.

VARICOCELE AS A CAUSE OF REJECTION OF RECRUITS FOR THE ARMY.

By Major S. G. ALLEN.
Royal Army Medical Corps.

A former number of the Journal contained an article by Colonel F. Howard, A.M.S., dealing with certain points in the Medical Regulations for Recruiting. With most of the author's observations and suggestions medical officers who have had to perform recruiting duty will, I think, be disposed to agree.

It is obviously true that a country whose military system is founded upon the principle of voluntary service cannot afford to reject recruits on account of certain commonly met with physical defects, which experience has proved to be not inconsistent with perfect military efficiency.

The existing regulations recognise this fact to a certain extent, but it is no doubt desirable, as Colonel Howard argues, that an even greater latitude should be granted the examining medical officer in certain cases than exists at present, and (I venture to add) that errors of judgment, which may occasionally arise owing to such a relaxation of the regulations, should not be too severely regarded, except, of course, such as could only be due to carelessness or ignorance. So far, then, we are probably all at one with Colonel Howard.

In dealing, however, with varicocele as a cause of rejection for military service, he makes so remarkable a statement regarding his own experience of this complaint, in its effect on the physical efficiency of the soldier, and draws from this statement a conclusion so at variance with my own experience, and, I believe, with that of most military medical officers, that I hope no apology will be considered necessary for attempting to call further attention to the subject in this Journal. The statement I refer to appears on p. 182, vol. ii., and runs as follows :—

"In an experience of thirty years I never treated an officer or soldier for varicocele."

He also asks: "Have any medical officers ever had officers or soldiers under treatment for varicocele, or been obliged to excuse them from any duty on that account?"

My length of service falls a good deal short of thirty years, but during the time I have been in the army I have certainly had a good

many soldiers under treatment, and have often had to excuse men from duty and send them to hospital on this account. Further, I shall be much surprised if this is not the general experience of my brother officers.

It struck me, however, that perhaps the best answer to Colonel Howard's question would be obtained by looking up the number of admissions for varicocele during 1903 at the hospital where I was doing duty (the Royal Herbert Hospital, Woolwich).

I find there were 35 admissions on this account last year (one being an officer), of whom no less than 26 suffered so much pain and inconvenience as to make them willing to undergo the operation for radical cure. In fact, I find that next to the operation for radical cure of hernia, the most frequent operation (of one kind) performed here in 1903 was that for the radical cure of this complaint. The following are the figures :—

	Operations.
Radical cure of hernia	34[1]
Radical cure of varicocele..	27[1]

It must also be remembered that the admissions to hospital only represent those in whom the symptoms were so severe as to unfit them for the performance of military duty at all. How many more had to be excused some portion of their duty (such as gymnasium classes) I have no means of judging. My own experience would make me expect to find there had been a good many.

However this may be, from the above figures two conclusions can, I submit, be safely drawn ; and the recruiting medical officer will do well to bear them in mind when deciding whether a recruit affected with varicocele shall or shall not be accepted for military service.

(1) That varicocele may, and not infrequently does, injuriously affect the physical efficiency of the soldier, and necessitate his admission to hospital.

(2) That as soldiers are certainly no fonder of being operated on than other people, the fact that men so frequently undergo the operation for radical cure is proof positive that this complaint is one that causes very real suffering, and that it is not merely the shirker and malingerer who goes to hospital on account of it. (For which reason also, a medical officer may sometimes hesitate to certify a

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[1] In one of these cases, under each head, the operation was performed on both sides.

prisoner with a well-marked varicocele as fit for punishment, without deserving to be straightway classed among the "Invertebrata.")

Consequently I cannot (with all due deference) agree with Colonel Howard that varicocele is, from a recruiting point of view, one of those minor defects concerning which the existing regulations might safely and advantageously be further released. They already sanction the acceptance, at the discretion of the examining officer, of recruits in whom the condition exists to a limited extent, and this, I believe, is as far as it is safe or prudent to go, with due regard for the Service.

As Colonel Howard in all his long service never had to treat a man for this complaint, it is no matter for surprise that he should consider a rejection rate of nearly 14 per 1,000 too high, and unfair both to the army (always in need of recruits) and to the individual desiring to serve.

To those officers, however, whose service experience has taught them to regard this condition (except when "existing to a limited extent," as the regulations say) as a not infrequent cause of military inefficiency, the numbers rejected on account of it appear by no means too numerous. If 10 per cent. of young male adults really are affected in this way, the fact that 86 out of every 100 men so affected are accepted for the army shows clearly that, so far at least as varicocele is concerned, no unreasonably high physical standard is demanded.

As I do not wish to further extend the length of this article, I will not go into the question of the effect of tropical service on soldiers enlisted with varicocele, but in an army such as ours it is a point which should not be lost sight of by officers entrusted with the responsibility of passing recruits.

VARICOCELE AS A MILITARY DISABILITY.

By Captain ROBERT J. BLACKHAM.
Royal Army Medical Corps.

Although regarded as a trivial affection in civil life, varicocele is a disease of considerable interest to the military surgeon, as it is a rare thing to see the morning sick in a large station hospital for many days without finding one or perhaps two cases reporting sick with some of the symptoms of this complaint, and it is most unusual to examine any considerable number of recruits without rejecting several for this disability.

The disease has a special interest for the present writer, as he only passed his Medical Board more than nine years ago on consideration of undergoing an operation for the cure of a slight varicocele. He hopes, therefore, he may be excused for choosing this disability as the subject of his first paper in the Corps Journal, although he is well aware he has little or nothing original to say in connection with it.

On consulting authorities on genito-urinary disease one is, however, at once struck with the great diversity of opinion which obtains with regard to the relative frequency of varicocele among the male population in Europe and America, and as this appears to be a matter which could be practically settled as far as the United Kingdom is concerned, by our recruiting returns, the writer ventures to offer the following *résumé* of our knowledge of the disease in order to invite the special attention of the Corps to its consideration. Moreover, he proposes to submit a suggestion with reference to varicocele in its special aspect as a bar to recruiting otherwise eligible young adults for the army.

Etymologically considered, the word varicocele simply means a tumour formed of dilated veins, but it has come to mean in surgery a varicose condition of the veins of the pampiniform plexus. In some of the older books the term cirsocele is used, but one never hears this name nowadays.

The pampiniform plexus is developed from the remains of the Wolffian body, and is formed at the hilus or posterior border of the testicle (M'Lachlan's "Surgical Anatomy," vol. ii., p. 461). The plexus ends in the spermatic veins, which pass up into the abdomen through the inguinal canal, and ascending on the psoas

muscle, behind the peritoneum, enter the inferior vena cava at an acute angle on the right side, and the renal vein at a right angle on the left (Gray's "Anatomy," p. 575). Both veins are very tortuous, form many anastomoses, and have few and imperfect valves (Treves' "Surgical Anatomy," p. 412).

The left spermatic vein is longer than the opposite one, and usually receives a couple of branches from the wall of the abdomen and fat about the kidney (Ellis's Demonstrations). Both veins are imbedded in loose cellular tissue, which yields them little or no support.

Causes.—With reference to the cause of varicocele, authorities are agreed there can be little doubt that the disease is induced by a constitutional vascular atony which shows itself first in those veins which are predisposed to varicosity. In susceptible persons the exciting cause may be :—

(1) Constipation of a chronic type. The left spermatic vein passes beneath the sigmoid flexure, so it can be readily understood that a loaded colon would play an active part in inducing the condition.

(2) Laborious work which tends to retard the flow of blood in the abdominal veins, and thereby produces engorgement of the pampiniform plexus.

(3) Congestion of the genitalia induced by frequent and unrelieved sexual excitement.

(4) Any circumstance which tends to continued distension of the spermatic veins, such as prolonged standing or excessive horseback exercise.

No one of these factors, nor indeed any combination of them, would be capable of producing varicocele unless some congenital lack of vascular tone existed, and Sir Frederick Treves goes so far as to say that "the congenital origin of varicocele is now very generally allowed" ("Surgical Anatomy," p. 412).

Masturbation was formerly held to be a cause of varicocele, but it is now generally conceded that varicocele is much more likely to be a cause rather than a result of self-abuse, seeing that it induces congestive irritation of the testis, and thereby sexual appetite, at a very early age.

Incidence.—Authorities are very divided as to the prevalence of varicocele, different statistics showing the disease as affecting from 2 to 75 per cent. of the male population. Chassaignac, of the New Orleans Polyclinic, considers that this great diversity of opinion is due either to different views as to the amount of

varicosity which should be considered pathological, or the different ages and classes of men examined.

The following are the chief statistics published :—

Henry found only 2 per cent. in a large number of men examined for the police.

Out of 166,317 recruits examined by Curling, in England and Ireland, only $2\frac{1}{2}$ per cent. were affected with varicocele.

Bennett holds that about 7 per cent. of all males have sufficient varicosity to be considered pathological.

Humphry and Keyes state that a "common estimate" of the frequency of the disease among all classes of the population is about 10 per cent., and this estimate is the one usually given in text-books on surgery, but Surgeon-General Senn, of the United States Army, examined 10,000 recruits during the Spanish-American War, and found more than double that percentage affected with various gradations of pampiniform varicosity; while Wertenbaker, after fourteen years' experience of examining recruits for a life-saving service, came to the conclusion that a slight degree of varicocele existed in no less than 75 per cent. of the men he examined.

Chassaignac examined 316 patients recently at New Orleans, and found forty-four affected on the left side, two on both sides, and one only on the right side. This would show a prevalence of almost 15 per cent. of the men examined, among whom were included representatives of all colours, ages and conditions, but the American surgeon, in the course of an excellent thesis on the subject, comes to the conclusion that Humphry and Keyes' "common estimate" that one man in ten is affected with varicocele is about correct. It would be very interesting to know if our recruiting returns for the United Kingdom bear out this conclusion.

Symptoms.—These are, of course, familar to us all, but it may be worthy of note that their intensity by no means corresponds with the severity of the disease. The best authorities consider that a small varicocele will frequently produce more suffering than a large one, so that when a soldier reports sick, complaining of severe neuralgia in a small varicocele we must not feel disinclined to believe him on account of the small amount of varicosity present. Moreover, if varicocele is a bar to military service, the smallest —if not operated on—is as much of a disqualification as the largest, as both may, almost equally, incapacitate the soldier for military duty.

It is not generally noticed in the text-books that varicocele may induce pruritus, intertrigo and eczema, but Chassaignac records a

ase in which distressing pruritus was the most prominent symptom. Apparently ordinary local applications were of no avail, but the condition was promptly cured by operation.

We are all, clinically speaking, familar with the neuralgic pains of varicocele, and are sometimes inclined to doubt their genuineness, as they often appear to be most intense when the subject of the disability is warned for some unpleasant duty; but that these pains are sometimes of the most persistent and distressing character is recorded by Curling, who states that several operators have performed castration for the relief of pain at the request of sufferers from varicocele.

Rose and Carless state that varicocele "is a frequent source of seminal emissions, and may result in testicular atrophy" ("Manual of Surgery," p. 1160), so it appears that in the interests of both the individual and military efficiency, when a soldier reports sick with varicocele the advantages of operation should be carefully explained to him, and we should only be content with the palliative measures when the patient declines operation.

Diagnosis.—The diagnosis of varicocele is usually extremely easy, but it may be mentioned that it is recorded that the disease has actually been mistaken for hernia, but not, of course, by a military surgeon.

The swelling always increases on forced expiration, and Rose and Carless state "there is a distinct impulse down the veins on coughing" (*vide supra*). Under this heading the marked predilection of the disease for the left side may be referred to. This is, of course, due to the anatomical difference between the two spermatic veins, which are summarised by Sir Frederick Treves, as follows: "The left testicle hangs lower than the right; the left spermatic vein enters the left renal at a right angle while the right spermatic vein passes obliquely into the vena cava, and the left vein passes beneath the sigmoid flexure and is thus exposed to pressure from the contents of the bowel" ("Surgical Anatomy," p. 412).

In Keen and White's "American Text-book of Surgery" we find the statement, "Sir Astley Cooper, Agnew, Marshall (who examined 30,000 recruits), and others, state they have never seen a well-marked case on the right side." This seems a moot point, for the present writer has seen several cases in India in which sufficient varicocele to be considered pathological existed on the right as well as on the left side, but he has never seen a case in which the right side alone was affected, which may be the meaning of the American authors. The experiences of R.A.M.C. officers examining large numbers of recruits would be interesting on this point.

Prognosis.—Rose and Carless affirm that "in favourable cases the condition disappears spontaneously," and Chassaignac states, "cases have been reported in which the disease disappeared after the patient had passed the age of thirty," but it is generally held that the disease tends to increase from puberty to middle life, and that either laborious occupation or indolent habits of life aggravate its severity. As the daily work of a soldier is one involving severe intermittent strain on the circulatory system, we may conclude that this disability tends to increase, as the result of military service, and that the subject of unoperated varicocele may eventually become totally inefficient as the result of the disease.

Pathology.—Mr. Howse was the first to maintain that in cases of varicocele there is an actual development of new veins, and this opinion is now generally endorsed. The veins form a pyramidal mass with the apex ending in the inguinal canal, and on examination are found to be tortuous and dilated. When cut they gape after the manner of arteries, and their coats are invariably hypertrophied, the tunica media being especially increased in thickness. In marked cases the testicle is generally more or less affected. It is always soft, flabby, and shrunken, and occasionally, but rarely, genuine atrophy results in consequence of interference with the circulation. (Keen and White's "American Text-book of Surgery," vol. ii., p. 928.) The testis on the affected side is sometimes tender, but more often, even when neuralgic pains are complained of, it is quite insensitive.

Treatment.—The palliative treatment of varicocele, which occupies a considerable space in text-books on surgery, only requires a passing reference, as the radical cure of the disease should be the aim of the military surgeon.

The operation elaborated by Bennett, which was performed on the writer nine years ago, is, of many, the one most in favour. It is described in the following concise terms by Mr. H. W. Allingham:—"The cord is grasped in the left hand, and the skin over the upper part of the cord made tense; an incision about three-quarters of an inch long is then made over the cord, commencing just below the external ring. The sheath of the cord is divided and the veins exposed; the vas deferens is then sought for and carefully isolated. An aneurysm needle armed with silk is passed beneath the veins, and the veins are tied firmly as high up as possible; a clip is next put on to the veins half an inch below the ligature, and the veins divided between the ligature and the clip. An inch or more of the veins is then separated downwards, and another ligature placed

round them at the lowest point. This is tied up tight, and the piece of the veins thus isolated cut away. The cord is returned to the scrotum, and the wound in the skin carefully united after all bleeding has been stopped. All the structures except the artery to the vas are divided and removed with the veins."

Conclusions.—Varicocele is a disability from which the patient may recover spontaneously, but which generally tends to get worse until middle age is reached. It is often the cause of intense neuralgia, and in some cases produces profound depression of spirits and other nervous symptoms. It is therefore very rightly a bar to enlistment, but its cure is possible by means of a simple operation which is almost uniformly successful.

In the writer's case the varicocele was completely cured by Bennett's operation, and there has not been the slightest recurrence of the condition, notwithstanding five years' continuous residence in India, during which period he played polo three days a week, and engaged in other active pursuits.

It appears that the disability is, at worst, merely evidence of some general vascular atony, and no indication of constitutional debility; and yet very frequently an otherwise perfect recruit has to be rejected for this single disqualification. This being so, it seems desirable that likely recruits whose only bar to enlistment is a moderate degree of varicocele, might be passed into the Service on the understanding that they submit to an operation as soon as possible after enlistment.

In all districts of the United Kingdom we have now Corps specialists in operative surgery who would be most competent to operate on these cases, so in these days of difficult recruiting it seems a pity to have to reject desirable young men for this simple condition, or at best send them for operation under civil surgeons, when we could readily cure them in our military hospitals.

This suggestion is, of course, not put forward in any controversial spirit, but merely submitted as an idea which has occurred to the writer in the performance of his recruiting duties in Ireland.

THE FLAGELLA OF DYSENTERY BACILLI.

By Lieutenant-Colonel C. BIRT
and Major E. ECKERSLEY.
Royal Army Medical Corps.

Shiga,[1] who discovered the dysentery bacillus, stated that from his first investigations he concluded that the rod was devoid of motility and flagella. Subsequently, however, after many attempts, he succeeded in demonstrating terminal flagella in one preparation. Schumann, quoted by Shiga, claims to have found them in several species, including Kruse's. Flexner[2] reports that his varieties were at first slightly motile, but soon become quiescent on artificial cultivation. The motility he observed was at best feeble, slow and laboured, and did not affect all the individuals in the field. Brownian movements were active. Strong confirmed these observations. Although Flexner's efforts to stain the flagella were unsuccessful, Vedder and Duval[3] demonstrated them by van Ermengem's method in Shiga's, Kruse's, Strong's and Flexner's varieties. They stated that the flagella were eight to twenty times the length of the bacilli, spiral in form, and dispersed about the bodies of the rods. Dunn[4] reports that he has isolated a bacillus identical with Shiga's, with very lively movements.

Nevertheless, the negative evidence is strong. Kruse[5], who was the next to follow Shiga in making researches on the specific microbe, found them to be unflagellated and motionless. Strong,[6] who admitted their activity, could not determine the cause by staining. Doerr[7] says that Shiga based his opinion on the movements in the hanging drop, which in doubtful cases gives play to the imagination, and to the discovery of a single flagellated rod, which might have been a water organism, since he did not use germ-free water while making his preparations. Zettnow, who eliminated this source of error, obtained negative results with Shiga's and Flexner's bacilli. Doerr himself has pronounced them unciliated. Vaillard[8] notes that dysentery growths suspended in water are endowed with lively oscillations which may simulate proper movements, but he definitely states that the bacillus isolated by himself is not supplied with flagella. The Doberitz[9] Commission concluded that the true dysentery rods were unflagellated. Borrel and Nicole have examined Shiga's, Kruse's, Flexner's, and Vedder and Duval's

bacilli, and have never been able to discover the existence of cilia. Firth,[10] who investigated twelve varieties, and Brown,[11] seven, have equally been unsuccessful. Lentz[12] asserts that with a sufficient *technique* it is impossible to recognise flagella in dysentery microbes; and he, in conjunction with Martini,[13] has gone so far as to describe as psuedo-dysentery bacilli cultures which possessed them, isolated from cases the serum of which, in high dilution, agglutinated the growths.

Gino de Rossi[14] is of opinion that it may be accepted as an axiom that it is futile to stain for flagella if the bacteria are motionless in the hanging drop. Motility is a very variable function. According to the researches of Eugen Fried,[15] it is best observed in agar growths which have been incubated at 37° C. for seven to twelve hours. Kruse himself admits that in determining the presence or absence of this character in the colon group caution is required, because power of movement is frequently of short duration, and may not occur under all circumstances. For transplanting, Kuntze[16] recommends a culture of a week's growth which has been kept at the laboratory temperature for some days. Agar slopes are inoculated with this and incubated at 37° C. for seven to ten hours. The change of temperature exercises a favourable influence on the flagella; they become thicker and stronger. Growing at one and the same heat produces flagella which are very sensitive to changes of temperature incidental to the process of emulsifying. Thus a nine-hour broth tube from a subtilis culture which had been kept in the ice-chest for a month, incubated at 37° C., showed lively movements, which were not impaired by the addition of water at 11° C., though iced water immediately paralysed it. The sensibility of microbes which have been long retained in the 37° C. chamber towards cold may cause it to remain doubtful whether loss of activity is due to the lessened temperature or to the absence of flagella. Fischer[17] has drawn attention to the fact that flagella may have become crumpled, entangled, or torn off, or dissolved by changes in the amount of salt in the media and water. Kuntze therefore advises the use of salt-free agar. Rossi, however, considers that, within limits, the proportion of sodium chloride present is immaterial; Gemelli[18] also holds this view. The agar slopes must be freshly prepared, and water of condensation should be still present; dry tubes are useless.

The material for investigations was as follows:—

A culture of Shiga's bacillus, kindly given by Mr. Pakes, the Government bacteriologist to the Transvaal.

Shiga's bacillus, from the Royal Army Medical College, London.
Flexner's Newhaven bacillus ,, ,, ,, ,,
,, Manilla bacillus ,, ,, ,, ,,
Vaillard's Vincennes bacillus ,, ,, ,, ,,
Indian dysentery, isolated by Firth ,, ,, ,, ,,
South African dysentery ,, ,, ,, ,,
,, ,, ,, isolated by Bruce,[19] designated "G."

For the above we are much indebted to Professor R. H. Firth.

Growths identical with Shiga's isolated in the Army Medical Laboratory, Pretoria, from seven cases of dysentery under treatment in the Military Hospital during the twelve months.

These were examined for motility, either in young agar emulsions or broth cultures. We can confirm Fried's observation that the former are to be preferred. Hanging drops were made on a slide, of fluid containing the living microbe, and of the same killed by heat. In every instance the movements of the living rods were contrasted with those of the dead from the same source. In this manner it was possible to pronounce as a vital phenomenon what would otherwise have been considered molecular oscillation.

Living activity was observed in all our cultures, though frequently confined to solitary individuals in the field, and so little marked that it might have escaped notice without the control of the lifeless bacteria. In the case of Flexner's Manilla bacillus, which does not conform in many respects with Shiga's type, the motility was greater. Some traversed the field of the microscope almost as rapidly as the enteric micro-organism.

The method of staining employed was Loeffler's,[20] to which one of us (E. E.) has devoted much time and care both at home and in South Africa.

Freshly prepared, and therefore moist, agar was used, which contained 0·5 per cent. salt, and required 20 to 25 cc. of normal alkali per litre to produce neutrality, phenol-phthalein being the indicator. Newly sloped tubes of this were inoculated from agar cultures of a week or a fortnight's growth, and were incubated at 33° to 35° C. for fourteen hours. Emulsions were made with water which had been distilled, and immediately afterwards sterilised in the autoclave. The cover-glasses were cleansed by boiling for ten minutes in a 10 per cent. solution of sodium hydrate, transferring them to a 25 per cent. solution of sulphuric acid, and then washing repeatedly with tap-water. They were immersed in absolute alcohol till required. The emulsion was prepared by allowing a small portion of

the culture on a platinum loop to diffuse in about 1 cc. of the germ-free water at the temperature of the laboratory—usually 16° to 20°C. —contained in a test-tube from which all trace of grease had been removed by means of strong sulphuric acid. The number of bacilli permitted to escape was sufficient to cause only the merest opalescence of the fluid. A cover-glass was taken from alcohol in a Cornet's forceps and dried in the air at room temperature. A loopful of the emulsion was gently placed on one surface, and was distributed evenly by gentle manipulation of the forceps. The film thus prepared was allowed to dry in the open air without the aid of artificial heat. The mordant of the following composition was then applied.

(*a*) A 25 per cent. watery solution of pure tannic acid.

(*b*) A freshly prepared, cold, saturated solution of ferrous sulphate in water.

(*c*) A saturated alcoholic solution of gentian violet.

Two cc. of (*c*) are mixed with 10 cc. of (*b*), and the mixture is added to 20 cc. of (*a*). The cover-glass, well covered with the mordant, was held over the flame until steam arose. After an interval varying from thirty-five to forty seconds the mordant was removed by washing with water, gently but thoroughly. The edge of the cover-glass, still held in the Cornet's forceps, was placed on blotting paper, which absorbed the superfluous moisture. When dry it was floated on Ehrlich's gentian violet in a watch-glass over a hot-water bath. This stain consists of 11 cc. of a saturated alcoholic solution of gentian violet in 100 cc. aniline water. The mixture is allowed to mature for twenty-four hours before use. Staining was continued for five minutes. The preparation was then washed with water, dried with blotting paper, and mounted in Canada balsam. In some cases the mordant was repeatedly applied. This caused the flagella to appear darker, but at the same time they were obscured by the increase of the granular deposit.

Shiga's bacillus from both sources was seen to be possessed of from two to six flagella. These were mostly terminal, rather short and thick.

In Flexner's Newhaven bacillus they were long, thick, and terminal. Only a minority of the rods seemed furnished with them.

On the other hand, in Flexner's Manilla bacillus they were short and wavy, and were found in the majority.

Vaillard, who could not affirm the presence of flagella in his variety, is probably mistaken, as in our culture of his bacillus they are numerous, fine, reticulated, very long, and readily seen.

In the Indian dysentery bacillus some of the rods had thick terminal flagella, some had a decided network.

Firth's South African bacillus had flagella similar to Shiga's.

Bruce's South African bacillus " G " was found possessed, for the most part, of short and thick flagella, usually two or three terminal. In some, however, there were distinct networks of filaments.

In all the cultures isolated in this laboratory flagella were discovered. They resembled chiefly those of Shiga's bacillus. In a few they approached more to the type of Vaillard's.

Conclusion.—We have demonstrated flagella in dysentery bacilli from fifteen different sources in every culture examined by means of the method given above. We are therefore of opinion that these microbes should be described as flagellated rods.

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REPORT OF AN OBSCURE CASE OF CRANIAL INJURY WITH ANOMALOUS SYMPTOMS.

By Lieutenant H. H. SCOTT.
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No. 5322, Private Bartlett, 7th Dragoon Guards, B Squadron, came up to the Military Hospital, Maritzburg, on the afternoon (about 3.30 p.m.) of Sunday, October 25th, 1903. He walked up, accompanied by two of his comrades.

The history of the patient's illness was by no means easy to obtain, as his own statement formed the only source of information (he had only been in the station a day or two to undergo a course of instruction in signalling), and he seemed irritable and did not reply very readily to questions. As far as could be ascertained, the circumstances were as follows : The previous evening, Saturday, October 24th, he was drinking at the bar of an hotel in the town, and after a time his comrades missed him. He does not seem to have returned to barracks that night, but was in camp the following morning, and went on parade as usual. He complained of headache during the morning and came up to hospital, as stated above, the same afternoon. He told the medical officer on duty that he had a headache and did not feel well, and after some questioning he stated as a matter of minor importance that he thought it might be due to "a blow on his head received the previous evening, after which he was unconscious, but could not say for what length of time he remained so," neither could he say who struck the blow, nor on what part of his head he was struck. He stated definitely that he had not vomited. His temperature then was 101·6°, and he was admitted to hospital. There was no localised pain or tenderness of the skull, and no bruise or any external indication of injury. There was no bleeding from the ears, and the membrana tympani was intact, and there was no subconjunctival hæmorrhage.

No other fact of importance was elicited except that he had been out in the sun, which had been very hot, both on that and the previous day. He had had, so he stated, no pain (except for the headache, which was not very severe), no vomiting, diarrhœa, shivering, or cough, &c. Except that he did not reply even as readily as before to questions, and that his temperature had risen to 102·6°, there was no great change in his condition that evening.

The following morning, October 26th, fresh symptoms declared

themselves. He was quite unable to give rational answers to questions; he was much more irritable and unwilling to reply, his speech was thick and hazy, and he said "yes" or "no" to anything asked, without reference to the nature of the question. When asked his name or number, he would either reply "yes" or "no," or repeat the syllable "chub," several times. He seemed to understand what was said to him, for occasionally, as when asked to name objects, as a watch, pen, key, &c., he would repeat the same syllable and then appear annoyed that he could not give the correct word. He was evidently suffering from motor aphasia. He was more irritable than on the previous evening, and could not be induced to write the names of objects shown to him for identification; agraphia, therefore, could not be tested.

There was no sign of any paralysis of face muscles, but he would not put out his tongue; there seemed, however, to be no affection of this organ, for when he opened his mouth he would move the tongue and no deviation to either side could be made out. The pupils were moderately dilated, equal on the two sides, and reacted normally. Knee-jerks were difficult to elicit as the patient kept his legs rigid, but when obtained, no difference was noticed in the two limbs. There was no paralysis of any limb muscles.

The same evening the temperature rose to 104·2°. He passed a very bad night, being exceedingly irritable and violent, requiring constant watching and only kept in bed with great difficulty. Calomel, grs. iii., had been given in the morning without result.

On the morning of the 27th the breathing was noticed to be somewhat hissing, noisy, almost stertorous in character, reminding one of the breathing of a patient in a uræmic condition. Temperature was 104·6°; pulse 146 and weak. He had had no action of the bowels since admission, so croton oil, ♏i., was given. He did not appear to recognise or take notice of any one, although he rolled his eyes from side to side and from one person to another. His head was shaved and an ice-bag applied, but even after shaving no sign whatever of bruising or external injury could be seen. There was no paralysis detected after careful examination again, though he certainly did not move the right arm and leg nearly so frequently as the left, often, indeed, only on stimulation. The legs were held too rigid to admit of the knee-jerks being obtained; the plantar reflex was present. Slight internal squint of the right eye could now be occasionally noticed, but this was by no means constant. The pupils were still equal, but the right reacted to light very much more sluggishly than the left, and the iris contracted and relaxed

slowly again and again while a lighted match was held in front of the eye.

A curious symptom also present was that the right cornea was very distinctly less sensitive to touch than the left. The patient allowed the former to be touched without showing any sign, and after three or four times merely turned his head as if annoyed, whereas when the left was touched he winced, as if it caused pain.

The same morning, as he lay in bed there was some retraction of the head; this was much more obvious when he raised himself in his delirium or tried to change his position. He passed his urine in bed, and had just done so before the morning visit, so none was obtainable then for examination. Temperature at 12.30 p.m. was 105·2°; pulse 150, weak and running.

About this time some urine was obtained by catheter, and in examination was found to contain about three-fourths albumen; there was no sugar. There was no evidence by which one could decide whether this was the cause of his condition, viz., uræmic poisoning, or whether the reverse was the case, and the cerebral condition, *e.g.*, by pressure, the cause of the albuminuria. There were no convulsions or fits of any description. The patient was obviously becoming rapidly worse, and as there were practically no localising symptoms of intracranial mischief to call for operative interference, he was treated by administration of pulvis jalapæ com., grs. lx. (the croton oil not having produced any result), of which he only took about half, and pilocarpin nitrate, gr. $\frac{1}{10}$, was injected subcutaneously, and he was wrapped in blankets. He very soon broke out into a profuse perspiration, but this did not have any effect whatever on the temperature. His general condition continued to get worse and the patient died at 3.10 p.m., without again recovering consciousness, and having been in hospital just under forty-eight hours. The temperature a few minutes before death rose to 105·6°; the pulse was very rapid, over 160 per minute and almost uncountable.

Autopsy performed nineteen hours after death. The body was that of a strong, well-built man, close upon six feet in height and well nourished. A complete and thorough examination failed to reveal any sign of external injury.

On reflecting the skin of the scalp there was a small ecchymosis, subcutaneous, but quite invisible from the exterior, about 2 inches by $1\frac{3}{4}$ inches, just behind and encroaching upon the right mastoid process. This was so slight that at first it was thought to be due merely to stasis, from the position in which the body had lain during the night.

Examination of the removed calvarium revealed the following condition :—

There was a Y- or U-shaped fissured fracture extending through the tables of the skull, but without any splintering or depression. The posterior limb of the U started from the junction of the temporal, occipital and parietal bones (the occipito-temporal suture forming the upright of the Y, if regarded as a Y-shaped fracture), and ran almost vertically upwards to within $\frac{1}{4}$ inch of the parietal eminence on the right side ; the anterior limb started from the same suture below, ran backwards and upwards for a short distance, then forwards and upwards, with a curve convex anteriorly, to end about $\frac{3}{4}$ inch in front of $\frac{1}{2}$ inch below the level of the termination of the posterior limb. Both limbs close to their origin crossed the lateral sinus, and occupying this part of the sinus where it grooves the bone was a small clot.

The convex surface of the brain showed marked congestion of vessels, and in parts of the anterior two-fifths there was a milkiness of the dura mater. There was no sign of any tubercles either on this surface or along the Sylvian fissure.

Over the site of the ecchymosis mentioned above, *i.e.*, the part enclosed by the two limbs of the fracture, was a circumscribed extra-dural clot of blood, closely adherent to the dura mater.

The brain was very carefully removed, disclosing in the base of the skull a fracture extending from the occipital bone, close to its junction with the temporal, downwards and forwards across the inner third of the petrous portion of the temporal, to enter the suture between the petrous and the basi-sphenoid.

The Brain.—The dura mater was somewhat adherent over the vertex ; there was no hæmorrhage beneath the dura or in the pia mater corresponding to the extra-dural one mentioned above, and there was no damage to the brain substance at that spot.

At the opposite pole, however (probably by *contre-coup*), there was a slight hæmorrhage over and a considerable laceration of Broca's convolution ; the anterior ascending frontal gyrus was also much lacerated. Extending apparently from this (or perhaps as a separate lesion) to the base of the brain was a clot about the size of a sixpence, but with ill-defined margin anteriorly situated just in front of the optic commissure to the left, between the median line and the left optic nerve.

All the organs of the body were examined, but with the exception of about $2\frac{1}{2}$ ozs. of slightly turbid fluid in the pericardium, no abnormal condition was found. The lungs were normal, as was

also the heart; the valves were competent and showed no sign of disease. The liver weighed 64 ozs., but appeared normal on section; the spleen weighed $6\frac{1}{2}$ ozs., the kidneys respectively 5 ozs. and $5\frac{1}{2}$ ozs., were normal on section, and the capsules peeled off readily. The intestines were healthy and the stomach contained no blood.

Remarks.—The main points of importance in this interesting case are: (1) The severity of the cranial and intra-cranial injury without any external signs; (2) the effects being so long delayed, namely, for several hours, the patient in the meantime being sufficiently well to be capable of performing his ordinary duties; (3) the question of diagnosis during life; (4) the cause of the lesion.

As regards the first of these, the patient in coming up to the hospital stated after a time and as a fact of minor importance that he had received a blow on the head. Nothing more definite than this could be elicited in the history, as stated above. A very careful examination was made, but no pain or localised tenderness was discovered, nor any sign whatever externally of a blow or injury to the head; and even when the head was shaved after the patient was admitted to hospital, and there had been some hours for any bruise to develop, no indication of any injury could be seen.

With reference to the second, it could not be ascertained from the patient exactly when the blow was received, since he was unable to say for how long he remained unconscious nor when he returned to barracks. He appears, however, to have been able to return alone and unaided, and to have gone on parade the following morning as though nothing had happened. According to his own statement he did not begin to feel unwell until late in the morning of the following day, though one of his comrades stated that "he had heard of his having vomited a little blood early that day." This was not reported till shortly before the patient's death, was merely evidence at second or third hand, and was uncorroborated, in fact, the patient himself denied having vomited.

The third point is the most important and most interesting, viz., the question of diagnosis during life.

The history being so uncertain and difficult to elicit, and the physical signs being so conspicuously absent, diagnosis during life was a matter of extreme difficulty, if not impossible beyond mere guesswork. The following suggestions were put forward from time to time by various medical officers who saw and examined the case:—

(*a*) *Enteric fever*, with very acute onset, as it were a fulminating type, with marked cerebral symptoms. This, of course, disregarded

the history of head injury, at all events as a causative element; this was not unjustifiable considering the vagueness of the history and its not being borne out by the presence of any external sign of injury.

The points in favour were: (1) The temperature steadily, though rapidly, rising; (2) the complaint of headache; (3) the presence of a furred tongue; (4) the condition of generally slow process of cerebration.

Against it were the facts that the headache was not a severe one, there was practically no previous feeling of malaise, it took no account, as already stated, of the man's statement as to his injury, and, finally, such cases are of such extreme rarity.

(*b*) *Sunstroke.*—In favour of this: (1) The man stated that he had been working in the sun, which, on both the 24th and 25th, had been very powerful (close upon 100° in the shade); (2) he was practically well on the morning of the 25th, being able to go on parade, and did not complain of feeling unwell till the middle of the day, when the sun was at its hottest; (3) the patient's high and rising temperature and general hazy mental condition, with violent delirium during the following night.

Against this diagnosis: (1) The peculiar aphasic condition, becoming more and more marked as time progressed; (2) the hearsay evidence that the patient had vomited in the morning, and had felt a little out of sorts shortly after early parade, while the day was as yet comparatively cool; though of course the hot sun of the day before might have started the mischief and the earlier sun of the next day have completed it.

(*c*) *Meningitis*; more likely cerebro-spinal meningitis, but possibly tuberculous. Prognosis: (1) Pupils not dilated, but the right reacting more slowly to light than the left; (2) retraction of the head, which supervened on the second day after admission; (3) the patient's general irritability; (4) sudden onset after a short interval, if of the tuberculous variety, induced by injury to the head.

Contraindications.—(1) There was no irritative sign such as spasm, twitching, convulsion, or fit of any sort; (2) no confirmed history of vomiting; (3) headache not very severe; (4) aphasia, purely motor, and no sign of any involvement of neighbouring areas, and no paralysis; (5) no history of tubercle, and patient seemed to have been a strong, healthy man previously; no signs of any affection of the lungs; also the symptoms came on almost too soon after the blow (if due to tuberculous meningitis) and increased in gravity with such alarming rapidity; (6) attempts at examination of the fundus oculi were strongly resisted, but as far as could be

seen there were no tubercles detected in the choroid and no sign of optic neuritis.

(*d*) *Uræmia.—Prognosis:* (1) The increasing unconsciousness, preceded by complaint of headache; (2) the character of the breathing; (3) the presence of a large amount of albumen in the urine.

Contraindications.—(1) No history of previous kidney trouble, and patient had not the appearance of a man suffering from renal disease, and nothing pointed to acute nephritis, such as pain in the loins, suppression of urine, &c.; (2) no history of previous headache (previous, that is, to the onset of the present one), no twitchings, convulsions, or epileptiform fits; (3) patient's age and previous good health; (4) urine passed quite freely throughout his time in hospital.

(*e*) *Intracranial Injury.—Prognosis*: (1) History of blow received a few hours before the onset of more acute symptoms; (2) general slow cerebration, and hazy mental condition; (3) the aphasia, its character and method of increase; (4) the condition of the pupils, both being large, but one reacting to light more sluggishly than the other; (5) the condition of the cornea, the right being so distinctly less sensitive to touch than the left; (6) the gradually increasing temperature and rate of pulse, in spite of profuse perspiration, pointing to pressure, or some form of irritation of the centres; (7) the albuminuria, possibly due to cerebral pressure also.

Contraindications.—(1) Interval rather prolonged for such acuteness of symptoms later; (2) no sign of blow or injury externally, yet symptoms severe and rapid; (3) no history of previous ear trouble, no disease, hæmorrhage, or perforation by aural examination, and no tenderness anywhere over scalp; (4) so far as could be seen, no sign of optic neuritis; (5) aphasia might be syphilitic, but no history of syphilis, and temperature still unexplained; (6) cause seemed inadequate from the history.

The question finally remaining is, what was the cause of the injury itself as seen *post mortem?*

Firstly, if the patient had been drinking heavily, and had sustained a fall sufficiently violent to produce such grave injuries, he would hardly have been in a fit state to find his way to barracks unaided, and to go on parade the following morning. Also, such a fall would almost certainly have cut the skin, and shown some signs of bruising either on the head or other parts of the body, according to where he was struck in falling.

Secondly, although the fracture to the calvarium was localised

to about three-fifths of the circumference of a circle of radius 1 inch to $1\frac{1}{2}$ inches, any weapon such as a knobkerrie applied over such a limited area would have, in all probability, cut the skin, and produced a considerable bruising, more marked fracture, with splintering of the inner table, with depression and its symptoms, whereas there was no splintering or depression whatever.

Thirdly, the injury may have been produced by some heavy, but dull, blunt weapon, which would give a blow whose force would be distributed over a comparatively large area, so as not to lead to any noticeable bruising or laceration of the skin. A sand-bag is a likely object to produce such a result, the man being struck from behind a forcible blow over the right side behind the ear over the occiput and adjacent mastoid, the bone being fractured over the prominent part of this area, and the fracture extending to the base. The violence of the blow would produce concussion, and by *contre-coup* laceration in the left frontal region of the brain, in this case the third left frontal (Broca's) convolution, the anterior frontal convolution, with some hæmorrhage at the base of the frontal lobe, either from laceration or rupture of small capillaries there.

Finally, the condition of the bones might have arisen from indirect fracture, as, *e.g.*, the man jumping from a window on to his feet, and so fracturing the base of the skull; this, however, would not be likely to produce the fracture of the parietal bone, and it also involves greater difficulty in explaining the laceration of the frontal lobe by *contre-coup*. Though it would account more readily for the small hæmorrhage of the optic commissure, but, as already stated, whether this last was a separate lesion, or whether the blood had come from the lacerated brain anteriorly, and gravitated there, I am unable to say; but I incline to the former, seeing that the staining was not quite continuous between the clot at the commissure and the laceration and staining from hæmorrhage at the anterior frontal gyrus.

After Note.

At the investigation held, after the above report was written, by the Criminal Investigation Department of Natal, it was brought out in evidence that the patient had received a blow on the head from a knobkerrie. It appears that he was wearing his helmet at the time, and in all probability, therefore, although the blow must have been a severe one to produce such extensive injuries, the localised force was rendered more diffuse by the hard covering of the helmet, and this possibly explains the fact that there was no external sign of injury to the skull.

THE TREATMENT OF ABSCESS OF THE LIVER: ITS DANGERS AND DIFFICULTIES.[1]

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I venture to bring the subject of liver abscess before you this evening, because I saw a great deal of this disease during my last tour in India. I make no pretence of dealing with it exhaustively, and in the remarks I have to make I will limit myself almost entirely to the results of my own experience.

During my seven and a half years in the Presidency District, Bengal, I estimate that I treated about sixty cases of liver abscess. I carefully tabulated my last thirty cases which, with one exception, occurred in the years 1901 and 1902, at Barrackpore; unfortunately I lost these tables during the confusion of packing up to return home. Of my last thirty cases fifteen died, or 50 per cent. This is somewhat lower than the figures for the whole of India, which show a case mortality of 56 per cent. in 1901, and 56·6 per cent. in 1902.

Before entering upon the treatment, there are one or two points about the diagnosis to which I would like to draw attention.

The diagnosis is not always easy. There is no disease accompanied by a constant rise of temperature for which abscess of the liver has not been mistaken. In 1901, there were in India eighteen cases in which the abscess was not diagnosed until the *post mortem*.

Cases occur, not infrequently, in which there are absolutely no liver symptoms. I have met men in the last stage of the disease, one of them rapidly sinking, with about 60 ozs. of pus in his liver, who was extremely angry with me when I told him that I thought he had an abscess. Such men used to say with an air of superiority that was rather trying, "I can assure you I have never had anything wrong with *my* liver," laying plenty of emphasis on the word "my." In cases of this kind the diagnosis is made by elimination.

Where you have a man suffering from prolonged fever of a hectic type, with night-sweats and rapid loss of flesh, and where there is nothing else to account for it, you have a case of liver abscess. I speak from my Barrackpore experience, for it must be remembered that liver abscess is largely influenced by locality.

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[1] Read before the Aldershot Military Medical Society, December 2nd, 1904.

There are few diseases in which a man loses weight so rapidly as in liver abscess. This rapid loss of weight is a very important sign; to appreciate it, you must weigh your patients regularly. I am glad to say that every Indian Station Hospital is now provided with a portable weighing machine.

Another point is the enlargement of the liver; I do not think there can be an abscess without enlargement, but our means of estimating enlargement are wanting in accuracy. I look upon percussion as absolutely unreliable.

A man's liver may be very much enlarged and yet percussion may fail to give any evidence of the fact. This is especially the case where the enlargement is towards the left, or backwards in the lower half of the liver. For the upper border percussion is all right, but for the lower I learnt to rely more on palpation, pressing the tips of the fingers well under the arch of the ribs. If you can get your fingers well under the arch of the ribs, between the liver and the costal arch, you may safely say there is no enlargement of the lower half of the liver; if you cannot even get the tips of your fingers in, there is considerable enlargement.

I need not dwell further on the question of diagnosis, except to say that you can rarely make an absolute diagnosis from the symptoms and signs alone; the furthest you get is to say, "I think there is an abscess."

Having got to this stage of well-founded suspicion, the next thing is to verify it and locate the abscess, by exploring the liver. This exploring is best done with the aspirator. There are generally three needles of different sizes. I used to be in favour of using the largest size, but now I think the smallest is the best.

The rule in exploring is to be ready to operate at once if an abscess is found; the reason, of course, is to avoid the chance of pus finding its way along the track of the needle and into the peritoneal cavity. I am not sure that the rule is altogether a good one. It is all right for superficial abscesses, say where the pus is within $1\frac{1}{2}$ inches of the surface; but for abscesses deeper than this, I am not sure that strict adherence to the rule will be followed by the best results, but I will return to this point later.

The best place to open a liver abscess, if you can reach it from there, is, I think, in the middle axillary line opposite the eighth or ninth rib. The eighth or ninth interspace is therefore the best place to explore from. When exploring, press firmly between the ribs with the forefinger of the free hand, until the upper border of the rib is distinctly felt, steady the point of the needle against the

tip of this finger and then push in boldly. It is not necessary to make an incision in the skin; see that your needle is sharp, and if it is not, give it a rub on the hone beforehand. If an abscess is not found withdraw the needle completely, and enter in a new direction from the same interspace or from the one next to it. From this neighbourhood you can explore in six different directions, straight in, downwards and forwards, downwards and backwards, upwards, upwards and forwards, and upwards and backwards. That is sufficient for the right lobe; of course, if there is a fulness below the arch of the ribs, either on the right side or on the left, you should explore in these places. When disappointed at the first insertion of the needle, I used to withdraw it partially, then deflect it and plunge it in in a new direction, this I do not recommend.

Many authorities maintain that this exploring is absolutely free from danger. In the great majority of cases no doubt it is so, but accidents do occur. I do not refer to wounding an intercostal artery, I do not believe this can ever happen, it certainly cannot to any one who remembers that the intercostals run on the inner side of the lower borders of the ribs, and takes the least trouble to avoid it.

In one of my cases I explored a man for abscess without result; he died in four hours from hæmorrhage into the peritoneal cavity. My only consolation was that his case was hopeless; he had an enlarged and pulpy spleen, a condition that is absolutely fatal. I explored his liver only as a last resort. What made me think that he might have an abscess, as well as the enlarged spleen, was that he actually had had an abscess earlier in the year, from which I had drawn off about an ounce of pus. After this single aspiration the abscess healed perfectly, as was seen at the *post mortem*. It is the only case I have ever seen cured by a single aspiration.

In another case I struck pus with the aspirating needle, but wishing to operate further back, so as to get better drainage, I withdrew the needle, to re-enter it behind. I was astonished to see pus from the abscess flowing out of the track left by the needle. It must at once strike one that if pus can flow out through the skin, that it may also find its way into the peritoneal or pleural cavities. It is a fact, I believe, that it very seldom does, but the possibility must be borne in mind. This case argues in favour of the rule to operate at once, but it was a superficial abscess.

In another case exceedingly free hæmorrhage followed aspiration; three punctures were made, all bled freely, the blood spurting out through the needle. I was very much afraid of internal hæmorrhage.

I got tight rolls of cotton-wool, a little larger than one's finger, pressed them well into the interspaces, and put on a very tight bandage. No bad results followed. No abscess was found. Maitland, of Madras, has published similar accidents following aspiration. Having found the abscess, you have to decide what operation you will do. Abscesses of the left lobe generally tend to point below the arch of the ribs, and must be opened by laparotomy. When situated in the lower part of the right lobe they sometimes tend to present below the costal arch, they can, of course, then be opened by laparotomy. If it is of any size, however, it can be reached from the ninth interspace. If the case were mine I would try to reach and open it from the ninth interspace, on account of the superior drainage. I have opened abscesses in this situation by laparotomy, and have subsequently had to make a counter opening, as the abscess could not empty itself. In the majority of cases abscesses have to be opened by the transpleural route.

Leaving Manson's special operation out of the question, you may proceed in either of two ways. You may open the abscess either by what I may call the "stab in the side," or by the excision of a portion of a rib. The stab in the side simply consists of plunging a straight bistoury into the abscess, along a grooved aspirating needle as a guide, and as you withdraw it making the incision sufficiently large to allow the passage of a large drainage tube. Good authorities pronounce this operation to be perfectly safe, and I have never seen any bad results from it. I never saw any other operation done at Netley.

During the year 1896 nine cases were operated on in this way at Netley, and they all recovered, except one. This operation has the advantage of being very simple, but it sometimes leads to great trouble in the after treatment, owing to the difficulty in replacing the draining tube when it slips out, or is taken out to be cleaned. I prefer to excise a portion of a rib.

The description given of this operation in most of the text-books, with the directions for stitching the pleura, diaphragm and peritoneum, is very complicated, but done in the following manner it is simple enough, and, what is of importance, everything necessary for the operation will be found in the capital case in every station hospital.

Supposing an abscess has been tapped from the eighth intercostal space, mid-axillary line. As soon as the presence of pus has been verified, disconnect the needle from the aspirating bottle and tubes, and plug the end of it to prevent the escape of more pus. Leave

the needle *in situ*, it will be useful as a guide. Make an incision fully three inches long, down to the bone, along the centre of the ninth rib, its centre being opposite to the needle. Clear the rib to the full extent of the incision, and incise the periosteum to the same extent, and in the same line. With one of the "elevators" scrape the periosteum downwards, from the incision to the lower border of the rib, free it well from the lower border of the rib, then, if you can, insert your finger between the lower edge of the rib and the periosteum, tearing the periosteum off as you do so, and pass your finger up behind the rib. If you can do this it makes the cutting of the rib with the bone forceps easier and protects the pleura from injury. If you cannot get your finger up, take the bone forceps as soon as the lower edge is free from periosteum, and pass the inner blade carefully so as not to wound the pleura, and cut the rib across in two places so as to excise 1½ inches. When the rib is cut across seize the cut part in the bone forceps or other strong forceps, and tear or dissect it away from the upper part of the periosteum. You will find this quicker than dissecting the upper part of the periosteum off in the first instance. It is much pleasanter to remove this piece of rib without wounding the pleura. If, however, the pleura should be wounded, no great harm is done—a wound of the pleura in this situation is not of much importance. You do not open into the middle of the pleural cavity, but only into a *cul-de-sac*, and collapse of the lung need not be feared. The next step is to stitch the two layers of the pleura, the diaphragm and the two layers of the peritoneum to the liver. I do this by two deep stitches, one at the upper part and the other at the lower part of the wound, inserted by means of the hernia needle threaded with gut. The stitches are put in without opening the pleural cavity. The upper stitch is always easy to put in, but it is usually necessary to dissect the periosteum and intercostal artery out of the way for the lower one, taking care not to cut the intercostal artery, which is usually unnoticeable.

Having put in and tied these two stitches, the upper one of which will close any wound you may have made in the pleura, make an incision across the gap in the rib, keeping in the line of the upper border, deepen this incision till you are through the liver capsule, then pass in your finger and feel for the guiding needle and follow it with your finger into the abscess. Remove the needle and get all the information you can about the size and exact situation of the abscess. Evacuate the abscess as much as possible and put in a large drainage tube—two if you have room. I do not think any

good is done by flushing out the abscess cavity, and I certainly do not advise that its walls should be scraped. Cut a small triangular piece out of the middle of the lower edge of your skin incision to make room for the drainage tube, then stitch up the ends of the skin incision, and be sure to put on plenty of dressings. This operation is simple, it takes from fifteen to twenty minutes to perform, and makes the after treatment very simple, for you will never have any trouble with the tube. With reference to adhesions, that is, adhesions that close up the peritoneal and pleural cavities, it is never safe to rely upon their presence. Even in cases where the abscess is very superficial they may be absent.

In one of my cases the abscess was so superficial that pus ran out of the needle holes when I was putting in the first stitch. I felt so certain that there must be adhesions that I withdrew the needle and did not put in the stitches. When I came to introduce the drainage tube, however, instead of putting it into the abscess I put it into the pleural cavity. I rectified the error and no bad results followed. After this I never omitted the stitches. I have also opened abscesses below the ribs, both on the right side and on the left, where no adhesions had formed. In these cases I stitched the peritoneum to the liver lightly all round the site of the incision.

Hæmorrhage is rarely troublesome, but I lost one case through it. I remember that there was very free bleeding through the aspirating needle when the abscess was explored, but as the abscess was very superficial I went on with the operation. When the abscess was opened there was again very free hæmorrhage, which I did my best to stop. I plugged the wound and abscess cavity as well as I could, but the man died, and at the *post mortem* a large blood-clot, about nine inches long, was found in the pleural cavity. It was something of a relief to find that it was a case of multiple abscess, and that nothing could have saved him.

In another case there was severe hæmorrhage into the abscess cavity about a week after the operation. This, I think, must be very rare. In this case there were two abscesses in the right lobe. I had operated and opened both into the same external wound. Hæmorrhage occurred into one, and at the *post mortem* its cavity was found full of blood-clot.

In treating liver abscess you are always very much in the dark; you suspect an abscess and explore, you find pus and operate, but you are still in the dark; you cannot say if the abscess is a single one, whether there are two or three, or whether the case is one of

genuine multiple abscess where there may be thirty or forty, and the liver little more than a bag of pus. This element of uncertainty is always present. It is, I think, for this reason that you very rarely meet with surgeons who care to have anything to do with cases of liver abscess. It is heartrending to lose case after case through no fault of your own, where you have operated successfully and relieved the abscess you have found, but have left others behind which carry off your patient. It is also unsatisfactory to have to say to the patient, " Well, if you have only one abscess you will probably recover, but if you have more than one you will almost certainly die, and I cannot tell you if you have more than one until I have operated on one and seen the effect."

It is a question if further steps should not be taken to ascertain if the liver contains more abscesses than one. This may be done by exploring the rest of the liver either before operating or after the first operation is finished.

In one of my cases I opened an abscess in the left lobe, and when I had finished the operation I carefully explored the right lobe to see if I could find any more abscesses there; I found none, and am glad to say the man made a rapid recovery.

In another case I explored and found an abscess in the upper part of the right lobe, but did not operate. Three or four days after I was going to operate, but before doing so I explored the lower part of the right lobe and found another abscess there; I was then able to open them both into the same external wound. This is the case I referred to above, where hæmorrhage occurred into one of the abscesses. This case points, I think, to some possible exceptions to the rule of being ready to operate as soon as you find an abscess. Where the abscess is deep there is, I think, very little chance of its contents escaping, while if you are content merely to draw off some of the pus, and this is not followed by a marked fall in the temperature and a good deal of relief, you have good reasons for thinking there must be more abscesses present. It is useless to the patient to open one abscess when there remains one still undiagnosed.

When you have successfully operated on a liver abscess you are not long left in doubt as to whether the case is going to do well or not. The prognosis generally stares you in the face the same evening. The temperature is the most reliable sign. If the temperature on the first evening is normal you may conclude that there are no more abscesses present and your patient is saved from the greatest danger. Signs of bad omen are an elevated tempera-

ture the first evening; the temperature may have fallen a degree or two, but this is not enough, if it has not dropped to normal you may suspect more abscesses; after a few days the wound becomes unhealthy, it refuses to heal, it gets covered over with a greenish coating, which probably extends over the whole of the abscess walls.

It is now your duty to begin again and explore the liver for another abscess, and you will be lucky if you do not find that your patient is your greatest difficulty. He has been losing ground rapidly since the first operation; he is feeling very weak and does not think he will be able to stand another operation; he has let you operate once and the result is not what he anticipated, he has lost confidence, and you will be lucky if he does not stoutly refuse to let you touch him again. Many men seem to think they are conferring a favour on you in letting you operate at all, and nothing will persuade them to let you operate a second time.

Where the man absolutely refuses you may still explore the liver without his knowing it, by exploring through the opening you have already made. The curved bladder trochar and cannula is as good as anything else for this purpose. I cannot say that I have ever seen this method succeed, and it should certainly never be tried except as a last resort, for every track you make through the liver with the trochar will become infected, as I have seen after death.

Single abscesses without any other complication are very favourable for operation. I have had cases completely healed in less than a month. I may remark that it is a common error to leave in the tubes too long.

At Barrackpore, dysentery was the most fatal complication. Where the dysentery persisted at the time of operation the result was almost always fatal. The commonness of plurality of abscesses and the concurrence of dysentery explain the comparatively large death-rates from this disease in India. It is quite impossible to compare Indian results with the results obtained at home. As I have said, nine cases were operated on at Netley in 1896, with a single death, and Mr. Cantlie has published some wonderful results. But it must be remembered that the cases that live to get home are the simple cases. The abscesses are usually single and there is no intercurrent dysentery. A single abscess without any complication should rarely be lost.

Before concluding, I would like to draw attention to a condition which I believe is rather rare. I refer to the formation of thick fibrous walls round the abscess; I observed five such cases at

Darjeeling, but never saw one anywhere else. The accepted idea is that abscesses with thick fibrous walls are very old. This is not always the case, as one of mine occurred in a young soldier who had been only about six months in India, and had never previously been out of England. But the most interesting thing about this condition is that this wall, which may be a quarter of an inch thick, sometimes sloughs off into the cavity of the abscess. This occurred in a woman under my care; I could only remove small pieces through the operation wound, and she died. I regret that I was not allowed to make a *post mortem* in this case.

SANITARY NOTES FOR RECRUITS.

By Major P. G. IEVERS.
Royal Army Medical Corps (Retired).

Ventilation, Drinking Water, &c.

Part III.

Ventilation.—No matter how large a room may be and how few the occupants of that room, after a period of more or less duration, according to the number of people in the room, the air will become foul and unhealthy unless provision be made for a fresh supply of air from outside, and different modes of ventilation, with a view to keeping up a constant supply, have been devised, one mode being known as the artificial, the other as the natural; the latter form should always be in vogue whenever possible. In barrack-rooms, such as you are accustomed to in England, it is easy enough to keep up the supply of fresh air by merely opening windows, which should always be done from the top and arranged so as to avoid draughts, which can generally be effected by attending to the direction of the wind. Having provided for a constant supply of fresh air from without, it is of equal importance to provide for the escape of the impure air from within.

Use of Ventilators.—It has been found that the expired air, or that which has already been, as it were, used up by breathing, being lighter ascends, so that in a room like this with a fairly lofty ceiling, the bad air collects high up overhead, and therefore we find the outlet ventilators situated, as a rule, at the top, and opening into the chimney flue when possible, as the draught, which is constant in all chimneys, speedily carries off all impurities by means of a kind of suction, so that the balance of inlet fresh and outlet impure air has to be maintained in all properly ventilated buildings. As regards the amount necessary for each individual, it is computed that an opening of at least 22 square inches is necessary both ways.

Dangers of Overcrowding. — We have only to compare the amount of mortality from lung disease or consumption in the old days of overcrowded barrack-rooms with the present, to be convinced of the great importance of the free circulation of fresh air in our barrack-rooms, for, in comparing the numbers per 1,000 men who died from consumption in the years 1830-36 with the years from

1871-76, we find the number of deaths reduced to less than half in the latter; no doubt this extraordinary diminution is directly attributable to the increased amount of cubic space as compared with formerly. You must, therefore, accustom yourselves to the free entry and exit of air in the barrack-rooms, at the same time availing yourselves of exercise in the open air when possible, which, in my opinion, is one great advantage in the life of a soldier, for which reason, too, it is easily understood why men in camp are always so much more healthy than when comfortably housed in barracks.

Advantages of Outdoor Life.—For similar reasons by all means cultivate outdoor games of all sorts during your leisure hours, and you will find yourselves healthier and happier men, for nothing that this world can give can make up for loss of this inestimable blessing, which you should endeavour by every means in your power to preserve.

Part IV.

Drinking Water.—The question of drinking water next claims attention, the paramount importance of which in the maintenance of health is no less than that of the purity of the air we breathe, or the food we eat, and in estimating the all-powerful effects of drinking water for good or evil we have only to enumerate the diseases resulting from a contaminated or polluted source of supply. With regard to the different kinds of water used for drinking purposes, the wholesomeness or reverse might roughly be judged in the following order, and firstly in this consideration, it is thought that rain water, if properly collected and stored, is about the purest of any, inasmuch as the only impurity it could contain is that gathered from the air in its descent; but with reference to improperly stored rain water, where tanks are subject to pollution or the means of storing becomes insanitary from any cause, such must be looked upon with suspicion. Secondly comes really good spring water, and that obtained from deep wells, if derived from a chalk or gravel soil, is best. Then, again, the water found on the surface of richly-cultivated lands is often dangerous; and although river water may be made fairly pure by filtering, still, inasmuch as most rivers contain sewage and other impurities of animal origin, it is generally considered unsafe; while shallow well water is often the most dangerous of all, as impurities of all sorts can so easily find their way thereto from the surface.

Characteristics of Good Drinking Water.—In appearance good quality water should be clear, free from odour, taste, or turbidity, and moderately soft; if sparkling when poured out all the better,

showing, as it does, satisfactory aeration. When the water supply is deficient the effect on the population is very marked, the death-rate always rising in consequence, and owing to the sewers being insufficiently cleared and the air poisoned therefrom, various diseases become frequent, such as diarrhœa, indigestion, enteric fever, and sometimes dysentery, whilst it is a well-known fact that the specific poison of cholera can also be conveyed in this way.

Effects of Impure Water Supply.—Similarly various kinds of tænia, or worms, and even leeches, can gain access into the stomach through the water consumed ; it is therefore highly important that you should exercise great care in filling your water bottles, and after all is said and done there is no safer method known for purifying water than that of simple boiling, which should always be done when practicable. For the reasons stated you should never on the line of march or elsewhere "go to the rear" in the vicinity of rivers or wells, but follow the system to which you are accustomed here of covering over with dry earth, a sanitary measure established since the time of Moses, and instinctively followed by many wild animals. You should never make light of an attack of diarrhœa—especially abroad—as such may, and often is, the forerunner of typhoid fever, dysentery and cholera.

Importance of Wearing a Flannel Belt. — A fruitful cause of diarrhœa, too, abroad, is very often the sudden change from a hot day to an equally cold night, than which nothing is more trying to the internal organs, and it is for this reason that the wearing of a cholera belt or kummerbund, made of flannel, becomes so necessary, for by this means an equal temperature or heat of the body is kept up and the danger of sudden chills avoided.

Causes of Heat Apoplexy.—On proceeding to India you will need to use something more than ordinary precautions, and then the peculiar power of the sun has to be remembered. It is important, therefore, to bear in mind the need of proper protection for the head, as obtained by the special kind of helmet worn ; and the man who fancies he can go about in a forage cap with impunity will soon find out his mistake. The character of the food, too, as sold in the bazaars should be considered, and all indigestible and unwholesome fruits carefully avoided. Nor does it do to fill yourselves with beer before "turning in" in such a climate, for by doing so it is not unlikely that your sleep would end in never awaking, this being a common cause of sunstroke or heat apoplexy, the very worst cases of which are apt to occur at night under the circumstances just mentioned.

Necessity for Temperance.—There you will need to be temperate both in morals and habits if you are to escape being invalided home with a constitution shattered, and thrown once more on your own resources, with perhaps the capability to earn a livelihood gone, very often, indeed, the result of one night's debauch. It is when you are in the beginning of your career that you should give attention to these all-important matters, and ask yourselves the question, when all is said and done, "Whether after all the game is worth the candle?"

A PORTABLE TROLLEY FOR USE WITH THE REGULATION STRETCHER IN THE FIELD.

By Captain R. H. LUCE.
Royal Army Medical Corps (*Vol.*).

The trolley consists of a single 28-inch pneumatic-tyred bicycle wheel, to the axle of which is attached on either side a triangular steel frame to support the stretcher. Each frame consists of a pair of half-inch steel rod stays fixed by a special hinge to the axle, and attached at their ends to a flat steel bar. This bar is 2 inches broad and 2 feet long, and carries, at either end, a clip into which the pole of the stretcher fits, and in which it is retained by a thumb-screw.

The hinge at the axle allows the frame to close up against the rim of the wheel, and to open out from it just so far as is required to take the width of an open stretcher. When this point is reached, by means of a slot hinge the frame slips over a projecting steel tongue, and becomes automatically locked. This makes the trolley rigid and non-collapsible, and prevents any wobbling of the wheel. To fold the frames again they are unlocked by raising them off the tongues. The whole trolley weighs 15½ lbs. When folded it measures 2 feet 2 inches long, *i.e.*, the diameter of the wheel, and 2 feet 11 inches high. The greatest width is 8 inches.

When open and fixed to a stretcher it raises the stretcher 2 feet 6 inches from the ground. This allows 6 inches between the canvas and the wheel for indentation by the weight of the patient. It is carried in the field by No. 4 of the squad by a strap over the left shoulder, and steadied by the right hand. The strap is buckled round the two horizontal bars of the frame in front and behind, and keeps it in the folded position. It is adjusted to the stretcher by the Nos. 2 and 4, or by one of them if only one is available, when the loaded stretcher has been lifted from the ground by the Nos. 1 and 3. Slings can or cannot be used as it is thought fit. They are not required unless rough ground is likely to be met with and the trolley has to be raised.

The stretcher with the wheel fixed forms a one-wheeled trolley, which is easily balanced by the bearers, and which can be pushed along as fast as the bearers can walk with practically no fatigue. It is also very easy riding for the patient. The balancing of the wheel is very like the riding of a bicycle, and is rapidly learned by

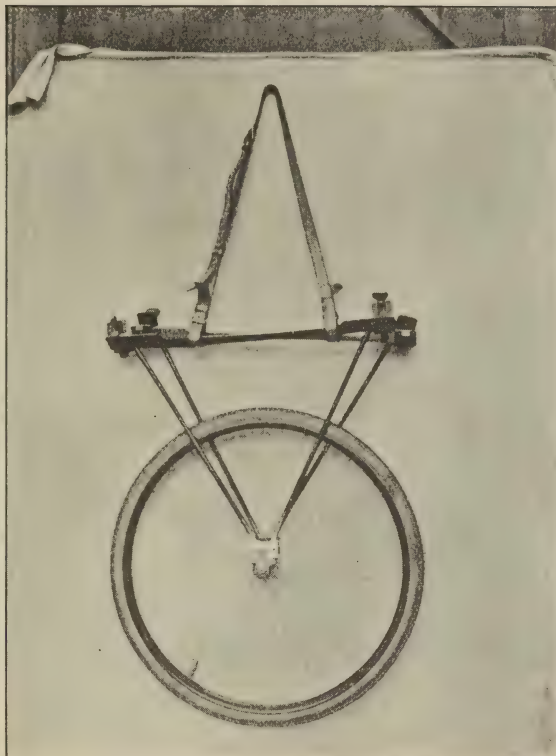

Fig. 1.—The folded trolley suspended by its strap.

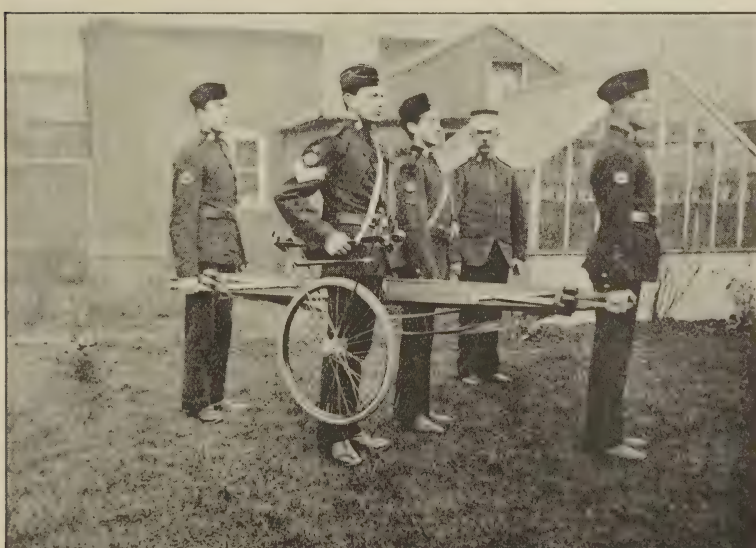

Fig. 2.—The trolley as carried in the field, with closed stretcher.

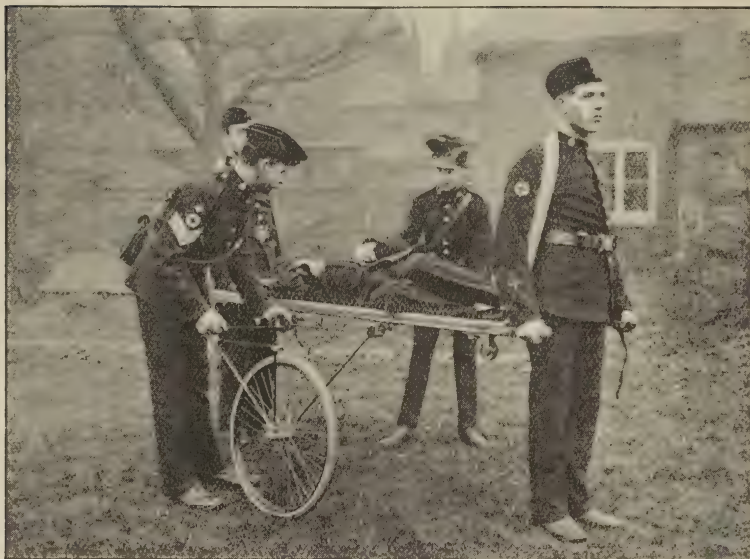

FIG. 3.—Adjusting the trolley to the lifted stretcher.

FIG. 4.—The trolley and stretcher adjusted for transport of patient.

the bearers. The position of the stretcher on the wheel can be adapted according to the weight on the stretcher.

This trolley has been thoroughly tried by the bearer company under my command in the field and found to work quite satisfactorily, and to save an immense amount of hard labour. It will run wherever there is a cart track or pathway, or on grass or stubble. Over small obstacles or rough ground it can be lifted without removing the wheel. In lifting over bigger obstacles the wheel is removed and readjusted when they are passed.

A pump and repair outfit can be carried by each squad, the former, as shown in the photograph, attached to the frame. The wheels are easily carried in the waggon by suspending them from the roof.

TREATMENT OF CHRONIC MIDDLE-EAR SUPPURATION.

By Major R. F. E. AUSTIN.
Royal Army Medical Corps.

The frequency of this disease and its intractable nature are well known. With regard to its intractability, neglect is at the bottom of it in nearly all cases, and the absurd popular prejudices on the subject often lead to this.

As besides polypi, mastoid disease, necrosis of the ossicles, and a host of other troubles, dangerous intracranial complications are likely to be set up, every effort must be made to put an end to the disease.

Uncomplicated chronic suppuration in the tympanum can be cured, and will be cured, if systematically treated, and the principles which should guide us are precisely the same as those that direct our line of action in suppuration of any other part of the body; thus, rigid asepsis must be observed, pent-up matter liberated, and the parts rendered as surgically clean as possible; regeneration of the tissues must be brought about by the local application of astringents, and impairment or loss of function of the part consequent on the inflammation must be combated (in the case of the ear this part of the treatment is rather apt to be overlooked in our desire to put an end to the suppuration). Attention should also be paid to the general health. Many of our cases will be difficult to cure, and will tax to the utmost the patience of the surgeon, attendants, and patient himself.

To render the tympanum clean and aseptic, it must be flushed out with some such solution as corrosive sublimate 1 in 5,000, carbolic acid 1 per cent., formalin $\frac{1}{4}$ per cent., hydrogen peroxide 10 volumes strength, &c. (To prevent repetition, it should be noticed that all solutions used for the ear must be warm, with the exception of rectified spirit.) Syringing out the ear in the ordinary way, however, only washes out the meatus, except when a very large perforation exists in the drum; so it will be readily seen that suppuration will continue if the tympanum is not thoroughly cleansed. It must not be supposed from these remarks that the syringe is not to be used, for in many cases with profuse discharge it is the quickest and simplest means of washing out the meatus.

The tympanum can be satisfactorily cleansed by ear-baths. The patient is directed to sit with his head on one side so that the diseased ear points upwards, the auricle is now drawn upwards and backwards, and the solution poured in out of a teaspoon until it appears at the mouth of the external meatus (if a heated spoon is used it will not be necessary to warm the solution, as contact with the hot metal will do this). The tragus is now pressed upon, so as to drive the fluid into the tympanum, where it should be retained for ten or fifteen minutes. In the case of a small perforation its entrance can be facilitated by making the patient hold his nose and swallow.

The efficacy of the bath can be still further increased by the simultaneous use of Valsalva's experiment, or Politzerisation, and to assist in forcing the air into the diseased ear and prevent it from entering the sound one, the resistance in the latter should be increased by holding it shut. For those cases in which cakes of inspissated pus and epithelium adhere to the tympanic walls there is an excellent remedy in hydrogen peroxide.

Although I had often heard of this drug, and seen its brilliant results on the hair, it was not until the early part of this year, when acting as clinical assistant at the London Throat Hospital, that I saw its equally brilliant results in aural surgery, and I have not been without a supply of it since. Under normal conditions, the reaction of this drug to skin and mucous membrane is very feeble, but when brought into contact with pus, it bubbles up with the formation of ozone, inspissated matter is liquefied and driven out of its hiding place, and the cavity in which the drug has been put is thoroughly disinfected. Flushing can also be carried out by syringing through the Eustachian tube or through a tube introduced through a perforation or fistulous opening; but as a more prolonged action of the drug can be obtained by an aural bath, these methods possess no advantages over it, except perhaps in those cases in which the tympanum is caked with inspissated pus and hydrogen peroxide is not available. Having rendered the ear as aseptic as possible, the fluid remaining in the tympanum is expelled by some form of air douche, the meatus is then dried with sterile cotton-wool and plugged with some antiseptic gauze or wool. It may be noted that it is sometimes necessary when a perforation is small or badly placed to enlarge it to allow of free drainage (as artificial perforations tend to close very rapidly, this must be prevented by frequently separating the edges with a probe).

This cleansing process will have to be repeated two, three or four

times a day, according to the amount of discharge. When it is inconvenient to dress so often, an antiseptic gauze dressing can be put over the ear after it has been plugged with gauze ; this should not be allowed to remain without change for over twenty-four hours, however.

If the perforation is large and the drainage free, an antiseptic powder, such as boracic acid, aristol, dermatol, &c., may be insufflated into the deeper part of the meatus before plugging. In some cases when discharge has become scanty, fluids seem to produce irritation and keep up the discharge ; under these circumstances the dry antiseptic treatment should be adopted. The ear is simply mopped out with sterile cotton-wool and packed with dry antiseptic gauze, or a little boracic powder insufflated before plugging with sterile cotton-wool. Many cases will get well with the antiseptic treatment alone ; on the other hand, some will require the application of astringents or antiseptics with an astringent action, before regeneration of the mucous membrane can be brought about, and for this purpose ear-baths of boracic acid and rectified spirits, grs. xx. to the oz. (momentary smarting is of no consequence, but if really painful it must be diluted with water and gradually strengthened as tolerated), carbolic acid and zinc sulphate, grs. v. of each to the oz., nitrate of silver, grs. v. to the oz., gradually increased to xx., acetate of lead, sulphate of copper, chloride of zinc, alum, and tinct. ferri. perchlor., in similar strengths have all been used with success. In obstinate cases these various astringent remedies must be tried in succession, and it is needless to say that those solutions which in themselves are not antiseptic must be sterilised before being used. When a large perforation exists, if thought necessary to directly stimulate the tympanic mucous membrane, this can be done by means of a fine probe, upon the point of which caustic has been fused.

A few words are now necessary regarding those after-effects of inflammation, viz., tympanic adhesions and permanent dry perforations. So far as adhesions are concerned, presuming our case has made progress towards cure with respect to discharge, or even from the first, it is necessary to employ some form of air douche to break down or stretch them. Later, suction by Siegle's pneumatic speculum or intermittent pressure on the malleus may have to be tried. In the earlier stages the form of air douche used is not of much consequence ; later, however, when cicatrisation is progressing rapidly, the stronger blast through a Eustachian catheter should be employed. In spite of every care, however, a certain amount of

deafness may ensue, and when it is great, the use of the knife has been advised, but the results have been so uncertain that its employment as a routine measure should never be thought of except in extensive bilateral deafness, and even then it is only fair to inform the patient that it is merely an experiment.

With respect to a permanent dry perforation its effect upon the hearing varies, and depends upon its position more than upon its size, for quite a number of persons have a very extensive perforation, yet their sound-perceiving powers are fair, or even good. That the membrana tympani and larger ossicles are not essential to good hearing is proved by the results of ossiculectomy and the radical mastoid operation, in both of which the whole of the drum, malleus, and incus are removed. In any case an artificial drum will often bring about a marked improvement in hearing. A roll of cotton-wool moistened with glycerine is the safest and best of these contrivances, and the patient himself is usually better able to adjust it than the surgeon.

The appliance should not be used until discharge has ceased for at least a month. At first it should not be worn for more than two hours at a time; as tolerance is established the time may be gradually increased. It should always, however, be removed at night; but as the tympanum is exposed, and the entrance of fluid is very likely to bring about a recurrence of suppuration, an attempt should be made to heal the perforation. This should be done by touching up the edges with chromic acid, the galvanic cautery, or repeated applications of trichloracetic acid.

Should our efforts fail, and they are not unlikely to do so, in very large perforations the dangers of allowing fluid to enter the ear should be pointed out, and the advisability of keeping the ear constantly plugged with cotton-wool insisted on.

The great secret of successful treatment for cure of the discharge is constant attention and cleanliness on the part of all concerned, with the almost daily supervision of the surgeon himself; and for this reason it is necessary to entrust the carrying out of orders to someone who has been instructed as to the importance of details.

Happily the soldier is in a position to receive the requisite attention, but in the case of his family and in civil life much of the treatment has to be left to relatives or friends, who do not realise the importance of surgical cleanliness. In this case written instructions are necessary, and they are best remembered and more likely to be carried out when given under the heading of "DON'TS."

The following, which I have had printed for distribution, cover the essential points:—

DON'TS

to be remembered in discharge from the ear:—

(1) DON'T forget to carefully clean your hands before syringing.

(2) DON'T forget to boil the syringe or keep it in 1 in 20 carbolic lotion.

(3) DON'T forget to employ boiled water whatever solution is used.

(4) DON'T forget, when giving an ear-bath, to see that the teaspoon has been sterilised before using by boiling or passing it through the flame of a spirit lamp.

(5) DON'T forget to only use sterilised cotton-wool taken out of an air-tight tin box with forceps that have been sterilised. (If two pair of forceps are used the wool can be rolled up for drying or plugging without being touched by the fingers.)

(6) DON'T on any account give the patient a supply of cotton-wool for self use.

In some very chronic cases, especially those that have been neglected for months or years, do what we will discharge continues. Presuming treatment has been systematically carried out carefully for six months, and we can exclude some complication that requires attention, or some septic condition of the mouth, nose, or naso-pharynx that is infecting the tympanum through the Eustachian tube, it is obvious that the tympanic mucous membrane is past redemption, and our only hope of bringing about a cure (for stop the discharge we must) lies in performing the radical mastoid operation, which, as is well known, consists in throwing open the tympanum and mastoid antrum into one large cavity, curetting it out, and allowing it to become lined with epithelium. The results of this procedure are extremely good; it is rare for any existing deafness to be increased, on the contrary, it is more frequently improved, whilst the effect on the general health due to the cessation of discharge is obvious to the most casual observer, and there should be no hesitation in doing it even on both sides if necessary. This operation is not a special one confined to otologists, it is described in every text-book on general surgery, as it is the recognised step prior to the carrying out of more extensive operations for the relief of intra-cranial affections consequent on suppurative middle-ear disease, and is therefore one that any army surgeon may be called upon to perform at a moment's notice.

When the disease is confined to that part of the tympanum above the drum known as the attic, treatment on ordinary lines is practically never sufficient. Owing to the presence of the ossicles and various

folds of mucous membrane, this region is divided up into numerous cavities which are hard to clean and drain, so the tympanic syringe must be used ; even then, however, in a very large number of cases, it will be necessary to remove the drum, malleus, and incus, with a portion of the outer attic wall. And the advisability of taking this step without too much delay will be apparent when it is remembered how closely the attic is connected with the cerebral cavity and mastoid antrum. Prolonged suppuration here is almost certain to lead to serious intra-cranial complications.

The treatment of the complications to be met with in chronic middle-ear suppuration is too vast a one to be discussed within the limits of a short paper. Suffice it to say that practically the majority of them will require attention before suppuration can be cured ; thus, if polypi are present, they must be removed; if there is caries or necrosis, the necrotic tissue must be got rid of. Finally, quite a number of the complications are only curable by the radical mastoid operation.

From a service point of view the advisability of keeping a man under treatment for so long a period as six months might be questioned. Personally I can see no reason why a soldier, with simple chronic middle-ear suppuration, should be admitted to hospital. For months past I have treated all such cases in barracks, the men are marked "Attending and Duty," and as long as they come to the hospital during the day at stated times for treatment, are available for duty. It may be difficult at some stations owing to distance, &c., to carry out this system. In those cases I would suggest that means be taken to get the men attached to the hospital for duty, or to units quartered within easy reach of the hospital.

As the treatment outlined can be more efficiently carried out with some special organisation, especially so when numbers have to be attended to, I have created a nose, ear, and throat department in my hospital, and find the work is minimised and better carried out by this arrangement.

A room for examination has been set apart for this class of diseases, and in it are kept all the appliances, solutions, &c., required for their diagnosis and treatment.

An orderly, specially instructed, is told off to look after the room and its belongings, and he carries out all treatment ordered. I find the men take a greater interest in their work if it is explained, and occasionally they are allowed to examine a nose, ear, or throat. All these things, though little in themselves, help to keep an orderly interested in his work, and all orders for treatment are consequently carried out with more zeal and intelligence.

WATER CONSERVANCY IN WAR.

By Lieutenant-Colonel A. B. COTTELL.

Royal Army Medical Corps (Retired).

I have been so much struck by the impracticable suggestions on this subject put forward since the South African campaign, that I am emboldened to give the following short account of the method I employed in January, 1900, to effect this end, when Staff Medical Officer of the camp at Slingersfontein, situated some thirteen miles east of Rensberg.

Nearly all the writers deal with methods of filtration, boiling, or addition of chemicals, but practically ignore the immense utility of preserving as pure as possible an already existing, fairly satisfactory source of supply. In saying this, however, I wish to entirely associate myself with those competent to judge of the immense importance of every possible sanitary precaution being taken. It is difficult to magnify the value of sound sanitary advice given to our combatant brethren, *if acted upon.*

Though it would be only too easy to relate many examples of the absolute ignorance or indifference to sanitary rules which I witnessed, such as men bathing and washing their clothes in the drinking water supply, I will content myself with one typical experience only.

A temporary camp was formed at Glen Siding, on the Modder River, about fifteen miles north of Bloemfontein. I found the water-carts there being filled from a nice-looking open conduit, which was fed by a clear, ample spring rising between rocks 300 yards away. It was by far the best source of supply I had seen during the war. It flowed, unfortunately, through a plantation, in the seclusion of which I found three men washing their dirty clothes in the conduit, *between the spring and the water-cart,* which was being filled under the *watchful* eye of a sentry.

On January 17th, 1900, the 9th (Colchester) Bearer Company left Rensberg, where we had been a week, experiencing desultory fighting and learning a few of the vagaries of that excellent, if somewhat difficult, animal the mule, and after a rather trying march of only thirteen miles arrived at Slingersfontein. Here we formed camp under General Clements, D.S.O., who afforded me every assistance, not only in the work I am about to describe,

but also in giving the necessary orders following sanitary suggestions made by me.

Early on the 18th I inspected the water supply and found that it was obtained from two sources—Raasfontein and Slingersfontein Farms, about one and a half miles apart.

The former was a natural spring, rising half a mile from Raasfontein Farm, which flowed through open conduits across a cattle track into a rough earth-sided tank; from there it was conducted in iron pipes to a well at the farm, the overflow from which fed the cattle pond. Slingersfontein was a small trickling brook, which came by natural underground filtration from a dam on higher ground, some 400 yards away.

On the 19th I obtained General Clement's consent to begin the work. All troops were ordered to water at Slingersfontein for two days, and a party of the 18th Royal Irish was placed at my command for work at the Raasfontein supply. With this regimental party and the intelligent assistance of some of my own bearer company we soon cleared the spring, conduits and tank of all dead vegetable and animal matter (a dead sheep amongst other things), and completely surrounded them with barbed and other wire. From the commencement of the iron piping to the well we were safe from contamination.

The well and the ground near I had cleaned, and the sides of the former raised to prevent the access of surface water. The water soon cleared after the necessary disturbance caused by our cleaning of the conduits and well, and an excellent supply was ready by the time promised. A sentry was posted at the well to prevent any dipper being used, except a clean bucket, kept for that purpose only.

The troops being now ordered to use the Raasfontein well only, I tackled the Slingersfontein supply, little dreaming of the amount of work before me. I asked for no assistance, the bearer company then, as always, working intelligently and willingly. After first surrounding with a wire fence the whole brook from its source, where it broke ground, I built a clay dam across the outlet, and rebuilt it many times before I realised the destructive and levelling power of retained water. The little brook, within forty-eight hours, became a fair-sized pond, and needed all our engineering skill to provide the right amount of overflow. (See fig. 1.)

From the farm I obtained a large wooden box (their rain water tank) and about fifteen feet of two-inch iron piping. The pipe was let into the side of the box, the inner end, coming to the centre, was covered by a perforated jam-tin, and the box filled with brick,

broken to the size of hazel-nuts. It was then sunk in the pond and the end of the pipe carried through the dam. A clear, good water supply rewarded our efforts. The water below the dam was used for cattle, horses and mules. The overflow, collecting in a natural hollow, was much appreciated for bathing at the upper part, and for washing clothes lower down. Later on the supply was so good that the Royal Engineers erected above the dam a field pump, which is seen in the illustration. The three separate snap-shots are overlapped to give a panoramic view, and will, I trust, make the letterpress easily understood.


FIG. 1.—WATER SUPPLY, SLINGERSFONTEIN FARM, showing the brook transformed in about forty-eight hours into a fair-sized pond. The box filter with iron piping, seen projecting through the clay dam, is seen in use. The overflow is covered by a bridge of planks. The Royal Engineers' stand-pump is shown filling the canvas horse-troughs.

Jam-tins for cups were so much appreciated by the troops that they were often commandeered; one is being used by Tommy, a spare one being on a post near.

Slingersfontein Farm was ransacked by the Transvaalers before we arrived. I had the building and surrounding ground cleansed and used it for a temporary hospital, and also as a cook-house and mess-room for the bearer company; the trying dust-storms were thus avoided. The operating tent is under the trees, with the bearer company's camp beyond.

I could not end this short account without acknowledging the valuable assistance I received from my excellent second in command, Major H. C. Thurston, C.M.G., R.A.M.C.

Remarks.—The special rules and suggestions I would call attention to are as follows:—

(1) Preserve immediately all existing good sources of water supply from contamination by men and animals.

(2) Boil all water when possible, and fill water-bottles with tea whenever occasion permits.

(3) An N.C.O. (artificer) from the Royal Engineers should be attached to the R.A.M.C. "field unit" (modified bearer company and field hospital combined). He would accompany the Staff Medical Officer (sanitary officer) to all sources of water supply, and attend to pumps and supervise the conservancy of existing supplies.

(4) The present water-carts should be condemned, no matter how serviceable they may appear, and a water-cart adopted which should have no internal angles, and should slope to a well, at the bottom of which a three-inch cock should be fitted to enable the interior to be rapidly and thoroughly cleansed. All water should be thoroughly strained through an easily cleansed canvas filter before it enters the cart. A filter might be fixed at the tap if a practicable one can be found. The Berkefeld so quickly fouled that it was often useless. A trustworthy N.C.O. should always be in charge of the water-cart. His duties would be to take every opportunity to keep it filled with good water, regulate the distribution, and be responsible for its cleanliness.

OBSERVATIONS ON BERI-BERI.

By Major H. E. WINTER.
Royal Army Medical Corps.

During my residence in Singapore, from November, 1898, until January, 1903, and especially during the period of nine months that I was acting health officer to the municipality, I had opportunities of seeing a large number of beri-beri cases, and was much impressed with regard to several points in the disease which I will endeavour to describe. Various theories have been put forward as to the cause of beri-beri, and at present in the Straits and Japan, the best favoured theory is, that the disease is acquired through eating mouldy rice and sun-dried, partly decomposed fish, the staple diet of Malays and Chinese. Then, again, you see it stated that it is due to a special germ, but so far, although many experts have worked hard with a view to discovering the germ, their efforts have been fruitless. There was a severe outbreak of beri-beri in the Christmas Islands in 1902, and this was put down to the rice. Some of this rice was sent to the health officer; I made many cultivations in different media from the rice, but without result, so far as a specific germ for beri-beri could be detected, although there were numerous moulds and common forms of bacteria present. Amongst other causes are mentioned over-crowding in ill-ventilated and badly drained houses. From many observations it seemed to me that the origin of the disease was more likely to be situated in the soil, and either miasmatic or due to a specific germ. I could not help being struck with the fact that the boot-wearing community, notably Europeans and well-to-do Eurasians, &c., rarely, if ever, acquired the disease. The only cases I came across in Singapore amongst Europeans were patients in the Tan Tock Sen Pauper Hospital, and these men were in the habit of going about without shoes and stockings, pointing to a possible infection through the feet from the soil.

I employed a Malay "kebun" (gardener); he had only been with me about three months when he contracted beri-beri, and left for his home in the Straits. I employed another; he also contracted the disease and left. Both these men were perfectly healthy when I engaged them, and it bothered me considerably to think that they should have acquired the disease at my house, and led me to hunt around for the cause. Under the bungalow there was a dark, badly

ventilated cellar, which was only intended for the garden implements, &c. Both these men were like the usual run of Malays, viz., very lazy, and passed most of their time sleeping in this cellar, and it seemed to me highly probable that the soil on the floor of the cellar might be infected with beri-beri. I had the cellar well cleaned out and thoroughly disinfected, the floor being washed with a strong solution of perchloride of mercury, and converted the cellar into a dark room for photographic work. The next gardener I employed, who was also a Malay, did not frequent this cellar, and although he worked for me for a period of over six months, he was quite well and had no symptoms of beri-beri when I left Singapore. This may have only been a coincidence, but it seems highly probable that the soil was infected, and the fact of the room being dark and badly ventilated assisted in the development of the disease.

In 1902 I was asked by the Eastern Extension Telegraph Company to go to the Cocos Keeling Islands on one of their ships, and to report on a severe outbreak of beri-beri amongst the Malay and Chinese coolies on their works there. I obtained three weeks' leave and went down in charge of a number of healthy coolies to replace those on the island. On arrival I inspected the small island, and it was evident that the disease had been fostered by faulty housing. These islands are of coral formation, and only a few feet above the level of the sea. The Chinese coolies were located in a large shed built of "attap" (dried palm leaves) covering a framework of wood; the "attap" reached right down to the ground, and there was very little ventilation and light. To add to this the hut was built in a hollow on the sea-level. The Malays were better off, being located in a wooden house raised off the ground for about two feet. Here, a peculiar circumstance struck me: the fowls, of which there were a considerable number, used to go under this building to scratch in the dry soil, and the inhabitants complained that their fowls were dying off, so that it would appear that even the fowls were dying from beri-beri, acquired evidently from the infected soil under this house. The Europeans were located on high ground in excellently ventilated habitations and were in perfect health. Just before my arrival some capital huts, termed "ponduks" locally, had been erected on high ground near the sea, for the purpose of accommodating the new coolies. These "ponduks" was a kind of lean-to, built of bamboo uprights, and the roof, which was made of dried palm leaves, sloped down from the front to within eighteen inches of the ground behind, the whole

area in front being open, so that ventilation was of the freest kind. The ground underneath was made up of large blocks of coral covered with smaller fragments and then levelled off. "Charpoys," well raised off the ground, were supplied for the coolies to sleep on, and nothing was allowed to be put under the "charpoys." I may mention that the idea was taken from coolie huts erected on the adjacent islands belonging to Mr. George Clunie Ross, the owner and governor of the Cocos, and he informed me that he never had any cases of beri-beri on his islands. Before landing the new coolies I recommended that the old Chinese quarters should be burned down, and this was carried out. The Malay house was thoroughly disinfected with strong perchloride of mercury solution, the ground underneath excavated to eighteen inches, the excavated soil being thrown into the sea and replaced by broken up coral. Wire netting was placed around to prevent the fowls from going under the house. The new coolies were disembarked and put in the recently erected "ponduks." All the old surviving coolies were brought back to Singapore. I heard some considerable time after that no fresh cases of beri-beri had occurred on the island. Now, looking at the fact that there were no cases amongst the Europeans, and that they consumed the same kind of rice, made into curries, &c., as the rest of the inhabitants, and that they were located on the same small island, but under different conditions, in that they were properly housed, I have no doubt that the disease must have been imported first of all by one or more coolies, and that these first cases contaminated the soil under the coolie quarters, the disease being fostered and spread by the insanitary state of their dwellings as regards ventilation, &c. Again, looking at the effect of change of surroundings, &c., on the sick coolies I took back to Singapore, I was informed that I should lose at least eight of the coolies on my way back, and looking at their condition I fully expected to, but from the date of embarkation they nearly all began to improve, and only three died, one of these dying within a few hours of reaching ship. These three cases were all "wet beri-beri," and I have always noticed when one can get beri-beri cases under one's own observation in a proper building and with careful supervision, that the "wet beri-beri" cases are the hardest to cure and more likely to be suddenly fatal. It is marvellous how quickly a case will terminate fatally. You will see a man in the morning suffering from "wet beri-beri," and who is apparently progressing favourably in every way, and a few hours afterwards will be sent for and find him struggling for breath and in extreme agony. These cases

nearly always point to the cardiac region and say "sini tuan" (Malay for "up here, Sir"), "suda mati" ("am dying"), and nothing will save him. I have tried venesection and found it useless. You frequently get temporary relief by administering nitrite of amyl followed up by doses of nitro-glycerine, but the relief is only temporary. I have always found cases of "dry beri-beri" yield to treatment more satisfactorily than "wet beri-beri." Cases of the former nearly always progress satisfactorily under favourable conditions, viz., location in a freely ventilated room, free diet of good milk and soup, &c.; iron, arsenic and strychnine, and especially the latter in the form of liquor, appear to be of immense advantage in promoting a cure. When the dry form has lasted some time, there is considerable wasting of muscles following peripheral neuritis, and massage is very beneficial, the Malays being especially adept in the art.

I have not attempted to describe the symptoms, &c., of beri-beri in this paper, as they have been so frequently described, but have limited my remarks to a few personal observations.

A NOTE ON MALARIA AT MOUNT AURIOL, FREETOWN.

By Captain L. F. SMITH.

Royal Army Medical Corps.

The garrison of Mount Auriol and Kortright consists of one company Royal Garrison Artillery and two companies 2nd West Indian Regiment at the former and one company of West Indian Regiment at the latter. These are parts of the Freetown garrison, although accommodated in barracks on the slope of a hill, 800 to 1,100 feet above the sea and separated from the town and native quarters by half a mile of uncultivated land. The sick are treated in the Station Hospital, Mount Auriol. During the period over which these notes extend, from the middle of August to the end of October, 1904, a period of two and a half months, I examined the blood of all men who came to hospital with fever, or who developed fever after admission, with the following results:—

Number of men suffering from fever..	100
,, ,, diagnosed malarial fever	39
,, ,, in whom malarial parasites were present ..	47
,, ,, diagnosed malaria, in whom malarial parasites were present	27

The diagnosis of malarial fever was made independently of microscopical examination, to find out the correlation between clinical and microscopical methods. It will be seen that, in practically 70 per cent., the microscope confirmed the diagnosis.

The remaining cases of fever, in which parasites were found, were chiefly venereal and slight surgical cases, who, during treatment, had an intercurrent attack of malaria.

In studying the variety of parasite found in these 47 cases, 46 showed only small rings, and judging by these alone, it was impossible to say which variety of malaria was present; but in 16 of the 46 a diagnosis could be made from the characteristic appearances of rosettes and gametes, nearly or completely grown.

The one case in which rings were not seen was a case of blackwater fever, showing one or two benign tertian gametes only.

The 16 cases in which it was possible to diagnose the variety of malaria were as follows:—

Malignant tertian	1
Benign tertian	2
Quartan	12
Mixed benign, tertian, and quartan	1

In addition to ordinary small rings with a single chromatin spot in them, a number of specimens (49 per cent.) showed small rings with two chromatin spots. These were of very constant character, *i.e.*, small rings or horse-shoes, with two distinct chromatin spots in one hemisphere, fairly close together, the intervening blue strip of protoplasm being extremely difficult and sometimes impossible to make out. Manson describes a ring with double chromatin spot as occurring sometimes; but being so frequently met with and of such a definite appearance it may perhaps be of some significance. These double-dotted rings were seen in 6 cases of quartan malaria, and in 16 cases in which small rings only were found. With the exception of one case of malignant tertian in which crescents were found, the cases were of a mild character and yielded to quinine at once. At this period, the rainy season, the *Anopheles* are not found in any quantity at Mount Auriol, as the pools and water-courses are frequently and thoroughly scoured.

Most of the malaria occurred amongst the West Indian detachment, especially that at Kortright on the highest ground, only 5 cases occurring in the European company. This is probably due to the fact that the West Indians are granted sleeping-out passes and sleep down in Freetown pretty often, and are thereby more liable to infection.

I carried out the microscopical work in the laboratory of the Sanitary Officer, Major F. Smith, D.S.O., R.A.M.C., who very kindly lent me every assistance he could.

SCHOOL HYGIENE IN RELATION TO VISION.

By Captain D. J. COLLINS.
Royal Army Medical Corps.

Among the multifarious duties of a medical officer in charge of troops in quarters, perhaps not the least important is the weekly inspection of the schools for soldiers' children, in the barracks or sanitary district under his charge. The chief object of this inspection is, no doubt, the early detection of infectious disease, in order that first cases may be isolated, arrangements for disinfection immediately undertaken, and the infection, as it were, nipped in the bud. This periodical inspection also often leads to the detection of scabies, tuberculosis, chorea, adenoids, granular ophthalmia, errors of refraction, &c. In this respect the military community is in advance of the civil, in this country at least, where periodical medical inspection of schools has not yet been adopted, although in America, Germany, and some other countries, the system has been tried and found to work with the most beneficial results.

There is no doubt but that in the spread of infectious diseases, such as scarlet fever, measles, diphtheria and contagious ophthalmia, the personal contact of children in schools is a most important factor, and the infection of scarlet fever, for instance, may be spread to an enormous extent by the contact of children in the close, ill-ventilated atmosphere which is found in many of our elementary schools ; the cubic space ranging from 90 cubic feet per head in the elementary schools to 130 cubic feet per head in the Board Schools. Under the system at present in vogue in this country we are dependent for our knowledge of the occurrence of infectious disease in schools on two sources, namely, the compulsory information given under the Infectious Diseases Notification Act of 1889, and the voluntary information supplied by teachers and others. When a medical officer of health becomes aware that a child attending a certain school is attacked with an infectious disease it is his duty to warn the school authorities, in order that the child may be prevented from resuming school attendance too soon after his recovery, and also in order that children living in the same house may be debarred from attending school before the expiration of the maximum incubation period. But, as pointed out by Kenwood, the danger is not so much from infected children resuming school attendance too soon, as from mild cases attending school before

they are diagnosed. Hence the need for the compulsory medical inspection of all schools, civil as well as military, for the early detection of infectious disease, and for what is almost of as great importance, the early recognition of defects of vision among the children, and the correction of errors of refraction.

While making an investigation into the vision of the children attending the different military schools in Dublin I was struck by two facts, first, the great extent to which errors of refraction prevailed among the children, and secondly, by the frequent occurrence of anisometropia, or difference in the refractive condition in the two eyes in the same child, one eye being perhaps normal ($\frac{6}{6}$), and the other slightly ametropic ($\frac{6}{9}$ or $\frac{6}{12}$), or one eye being more myopic, hypermetropic, or astigmatic than its fellow; this condition, in my opinion, being often the result of inadequate lighting arrangements and faulty illumination of the children's books.

It is stated by Cohn that all children are born hypermetropic, that 3 to 5 per cent. of school children suffer from myopia, while by the time the university age is reached the myopia has attained the alarming proportion of 20 to 40 per cent. Now this disease, myopia, is largely the result of faulty school hygiene, and therefore to a great extent preventable. Leaving aside the questions of ventilation, which is notoriously deficient in most of our public elementary schools; of warming arrangements, by means of which, with ill-constructed cast-iron stoves, and absence of proper air inlet for the stoves, carbon monoxide, that most poisonous of gases, is frequently circulated in the school-room; or drainage, and of other important bearings on the health of the children, I shall only deal with the conditions which affect the eyesight and predispose to that grave affection, progressive myopia. The health of the child is quite as important as its intellectual or mental development, and it is essential that the best possible hygienic conditions should be provided for both pupils and teachers.

The first point to be considered in this connection is the lighting of the school-room; but before describing the ideal lighting arrangements, it may perhaps be better to state what they ought not to be, as illustrated by a large school-room which I visited in Dublin. The room was of rectangular shape, 60 feet long by 40 feet broad, and 17 feet high; the air space was 40,800 cubic feet; the number of children attending the school was 160, working out to about 250 cubic feet per head. The area of window-glass was

334 square feet, and the floor space 2,400 square feet, the ratio of glass to floor space being as 1 to 7·185. This ratio should never be less than 1 to 5, and the nearer the area of the glass approaches the floor area the nearer will the ideal standard be reached. The arrangements for lighting the room consisted of eight windows with small diamond-shaped panes of glass, situated four at each side of the room, the doors being at the ends. The ventilation was provided for by ten Hopper ventilators in the windows, six air-bricks in the wall, and twenty-four feet of ridge tiling raised to give $1\frac{1}{2}$ inches of air space at the top of the roof. Warming was arranged for by a single large cast-iron stove, situated in the centre of the room, with a flue passing through the ceiling. It may here be mentioned that the Board of Education rule states that an "iron stove with a pipe through the wall or roof can under no circumstances be allowed," owing to the danger of carbon monoxide gas being generated. The desks were arranged in four parallel rows at the long sides of the room, and placed with their backs to the windows and the light, the result being that the light fell, not on the pupils' books but on the pupils' backs, so that to get more light on their books they are obliged to "screw" round, and consequently the strain in reading falls on one eye only. In this way the occurrence of the anisometropia alluded to above may be explained. The desks were all of one size, although the children varied in height from 3 feet $6\frac{1}{2}$ inches to 5 feet $4\frac{1}{2}$ inches; the height of the seat was $17\frac{1}{2}$ inches, the desks themselves being 30 inches from the floor, and a foot-rest was provided for the smaller children.

It will thus be seen that the arrangements of this school, which may be taken as a type of the rest, were faulty in regard to lighting, warming, position of the desks, and construction of the seats and desks.

The defective eyesight of school children is due to two causes: (1) Imperfect illumination; (2) too great distance between the desk and seat; the books or writing should not be distant from the eyes less than 14 inches. The windows should be so placed, or what comes to the same thing, the desks should be so arranged, that the light comes from the left side, or from the left and rear, and so falls on the books over the children's left shoulders. Next to this plan comes that with windows at both sides of the room, so that both sides of the book are more or less equally illuminated; this system answers well if the light from the left side is the stronger; but on no account should the windows be directly in front of, or directly

behind, the desks. Unequal illumination of the printed matter or writing results in unequal strain on the eyes, and in one eye being used more than the other, or in the eyes being brought nearer the work than the child's near point; all of which conditions tend to the production of myopia. The windows should be five or six feet from the ground, the horizontal rays coming from lower than this being too bright and dazzling; they should be carried up as near the ceiling as is possible, as the best light comes from the highest parts. Sky-lighting is probably the best of all the methods of lighting a school-room, but it is open to the objections that in summer the heat may be too great, while in winter the difficulty of warming the room is much increased. The best colours for the walls of schools are the more delicate and lighter shades of yellow-green, or light grey.

Home lessons play an important part in the production of myopia in children; they are undertaken when the body, the mind, and the eyes are fatigued. The children, after spending seven or eight hours in school, are obliged to pore over the home lessons for two or three hours, and at a time when there is no teacher or other responsible person present to regulate the manner in which the light should fall on the books; too often the illumination is from an oil lamp in the centre of the table, while the children sit around. Again, what is commoner than to see a small child sitting near a fire, or stretched on the hearthrug, reading a book with the aid of the flickering firelight only?

The desks in schools should be so arranged that the child will find it more comfortable to sit upright than in any other position. For the attainment of this object the seats and the tops of the desks must be of a height from the ground suitable to the requirements of each child. The seat must allow the soles of the feet to rest on the floor, and its height should be equal to the distance from the sole of the foot to the angle formed by the leg and thigh, when the latter are flexed at a right angle. The seat should be as wide as the length of the thigh, sloping neither backwards nor forwards, and slightly concave, to prevent the child from slipping. The front edge of the seat should be placed one to two and a half inches from the inner edge of the desk (Norris and Oliver). If the desk is too high the arms cannot rest on it without forcing the shoulders upwards; while if the seat is too high the child must stoop over his work, the upright position is rendered impossible, and curvature of the spine may be induced. The top of the desk must incline towards the pupil at an angle of 30 degrees for writing, and 45 degrees for

reading, and it must be low enough to permit the forearms to rest lightly on it without raising the shoulders while writing; the lower part of the back and the pelvis should be supported by a rest which can be easily felt when the pupil is sitting upright (Norris and Oliver). Children of the same age vary considerably in height, and children of the same height vary in the measurements of different parts of the body; it is obvious, therefore, that the same type of desk will not suit all pupils. The desks should be constructed to suit individual children; they should be single and each readily adjustable, that is, the desk and seat should be capable of being raised and lowered to suit the requirements of each case. A separate desk for each child would be the ideal arrangement, but failing this, the desks and seats should be of three or four sizes, and the children should be allotted to them according to their measurements.

The books used by the pupils should be printed on good paper and in bold type, and it should be borne in mind by the teachers that the strain on the eyes is much less at the far point than at the near, and that instruction given by means of blackboards and maps is less fatiguing than that with paper and pen; while with young children oral instruction is much better than work at the near point.

THE ANKYLOSTOMUM, THE STRONGYLUS, THE TRICOCEPHALUS, THE ASCARIS, AND AN ASSOCIATED INFUSORIAN IN WEST AFRICA—CHIEFLY IN REGARD TO MILITARY INEFFICIENCY; MODES OF INFECTION, AND LIFE-HISTORY OF THE PARASITES; ALSO A NOTE ON AN UNIDENTIFIED WORM.

By Major F. SMITH, D.S.O.
Royal Army Medical Corps.

(*Continued from p.* 12.)

Part II. (*continued*).

The presence of ankylostomes in very young puppies suggests, of course, that infection was due to the puppies having sucked off the skin of the mother embryos derived either from her own fæces or from an outside source. There is, however, no certainty that infection was not through the skin of the puppies. The subject is a difficult one. A series of experiments extending over a year have been carried out in the hope of elucidating it. In the course of the experiments there have been revealed some remarkable and suggestive phenomena connected with the life-history of a worm found in human and other fæces, a worm[1] which may or may not be derived from an ankylostome. I have no hesitation in setting forth these phenomena in print, for their zoological interest, apart from any possible connection with ankylostomes.

Cultivation of Embryos in Agar.

Ankylostoma-infected fæces of the dog were placed on an agar plate at air temperature, ranging from about 70° to 89° F. The fæces had not been in contact with the ground, but had been exposed to the air. Next day many embryos were observed to be freely moving in the agar. They grew rapidly. There were noticed also in the agar some similar organisms which showed sexual distinctions; others were filariform and asexual. The sexual organisms were full-grown in a day or two. The female at first shows a white crescent on one side—like the so-called V spot in *Filaria sanguinis* (fig. 2).[2] By and by a dimple appears

[1] Feeding and skin experiments with this worm are detailed further on in this article.
[2] See illustrations further on.

in the middle of the crescent. Finally the female is seen to be packed with eggs extending on both sides of the genital orifice nearly to the mouth and tail ends (fig. 5). Two large, well-developed, nucleated eggs are usually prominent, one on each side of the vagina. The female has by this time got a long, flowing, finely-pointed tail. The male is smaller than the female, more cylindrical, and has scarcely any tail. He has a well-marked pointed penis, which is sheathed in the body when not excited. In the dead worm this organ remains in extrusion (figs. 4 and 7).

The organisms move equally well either backwards or forwards with a side-to-side, serpentine movement. They progress with greater ease in a stiffish substance like agar than in fluid; their wriggling in the latter is more rapid but less effectual. In moving backward in a semi-solid medium, the colourless terminal filament of the tail is often doubled back passively on itself—it is not necessary to movement.

The females lay eggs resembling those of the adult ankylostome, and at any stage of development—ranging from the egg with a nucleated yolk to that containing a writhing embryo (fig. 5a). The eggs quickly hatch out young embryos.

Cultivation in Water.

Ova[1] of dog ankylostomes were placed in a shallow layer of distilled water and were examined every day. The embryos hatched out, moulted, and lived for three weeks an active life, in spite of the poorness of the medium. They gradually died off. They remained filariform throughout and showed no sexual marks such as those described above.

Human fæces containing ova were put into water. The embryos flourished for eight weeks, presumably nourished on the fæces. Here, too, the embryos were asexual throughout.

Dog fæces containing ova were treated as above: the embryos behaved in the same way, but lived much longer, viz., three months. It is quite certain, then, that *drinking water does not kill the embryo.*

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[1] To make sure of the identity of the ova the following method was devised: A dog, known to harbour ankylostomes, is killed and the adult parasites removed at once from the intestine, washed in distilled water, placed in fresh water or on a sterile Petri dish, and incubated for an hour or two. The adults continue laying eggs for some time. Some will live for three days. Couples may remain *in coitu* for a long time. While so situated, and without disjoining from the male, the female in water may be seen to eject, from time to time, with a gush, little clouds of brown granular matter along with several ova.

I must say, however, that the embryo does not do well in deep water, in a test-tube, for instance.

Human fæces containing ova and young embryos were placed in tap-water. For more than two months asexual embryos only were found in the water. The water was then allowed to almost dry up. When three months old the preparation consisted of green algæ not quite covered with water. A few attenuated parents similar to those already described were moving about in it.[1] There were also some young embryos. Here and there an egg was to be seen. The organisms were evidently maintaining a precarious existence. They were removed to glucose-agar, in which they bred rapidly and grew to robustness.

A portion of the first-mentioned infected agar was placed in shallow water: the organisms flourished and bred under and in the agar, but very few were found in the open water.

Another portion of the same agar culture was mixed with water, spread over a slide and covered to prevent evaporation. Growth and breeding went on.

Growth in Fæces and Urine.

If fæces containing the breeding organism be kept moist, breeding goes on for three months or more in the way described above. Examination day by day reveals newly-hatched embryos. Eggs will be seen in great number: evidently generation after generation is being born. I usually place the fæces on a folded piece of linen, or on sterile earth in a glass capsule, watch-glass, or any convenient receptacle. The specimen thus prepared is kept in a tin covered with mosquito netting, or the tin may be perforated. The linen or earth is moistened daily with water. The organisms do as well on the linen as on the earth. *Earth, therefore, is not essential to their existence.*

In a mixture of fæces and urine growth is vigorous and continues for many weeks, in spite of decomposition of the medium.

Other suitable media are gelatine, moist earth, moist sponge, charpie, milk, &c., but the agars are the best in which to observe the behaviour of the organism.

The Organism is Viviparous as well as Oviparous.

The remarkable method of producing living embryos was watched. Embryos were seen rushing up and down the body-case

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[1] In explanation of this apparent contradiction see note further on.

of the female, twisting and turning much like the embryo in the egg of the adult ankylostome, but with more freedom (fig. 8). After wandering up and down, butting at the wall of their prison, pushing their noses here and there in search of a weak spot, one of the embryos was seen to get its head through the skin of the parent. The wriggling of the embryo now became more rapid. It was soon through and glided away; one by one the others found their way out, and the limp, motionless carcass only was left of the parent (fig. 9). Why the embryos do not all come through the genital orifice is not clear. Sometimes a live female may be seen to contain at one time free embryos, eggs containing writhing embryos and ordinary eggs with a granular yolk.

Conjunction of the Sexes.

The male uses his short, curved tail as a sort of director. He glides the convex surface of the tail up and down the body of the female till by chance he hits off the orifice. After that he seems to retain himself in position by hooking in his horn-like penis. The longest period of contact noted was twenty seconds. The tail is perhaps also an organ of sense, so to speak, for the male touches his companions indiscriminately with it, the immature and those whose eggs have already been deposited, and seems to be able to tell at once by this means whether he is to leave them alone or not.

The position of the conjoined worms is somewhat like that of adult ankylostomes, and distinguishes them from the strongyles.

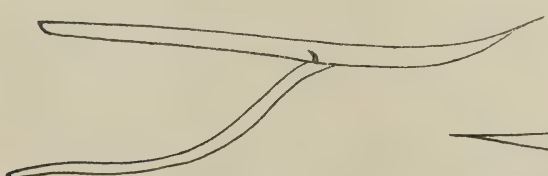

FIG. A.—The organism *in coitu*.

FIG. B.—Strongyle (free form) *in coitu*.

The Traveller.

If the surface of ankylostomal fæces be exposed to the air for a few days in such a manner as to remain moist, and be then carefully examined, there may be seen on it, provided it has been isolated in a dry receptacle, numbers of little white thread-like objects. Attached by one end to the fæces the little bodies look like polyps

waving in the air. They are best seen with a hand-lens. As time goes on the polyps become more and more numerous, and yellowish petals may be seen waving about like tongues of flame (fig. 10). The petal, *seen by the naked eye*, resembles, and might be mistaken for, a worm. Touch a petal with a needle, dip your needle into a drop of water on a slide and place the slide under the low-power lens of a microscope. You will now see that the yellow petal has resolved into any number, up to a hundred or so, of filariform, asexual embryos busily dispersing themselves about the water —most of them being at the edge of the drop with their heads pointed outwards (fig. 11).

By narrowly watching the surface of the fæces you may see these marvellous collections of embryos formed. One embryo rears up and waves itself in the air; another one climbs up the first one, and perhaps waves about from the head of its supporter; then a third embryo will swarm up number one, and so on until a petal is formed. All the members of a petal move in unison, and produce the curiously deceptive appearance as of a single worm.

Occasionally, instead of waving polyps, aggregations into little heaps are seen; these collapsed petals resemble fragments of wet cotton-wool. Sometimes, in moist weather, droplets of water are occupied by many of the embryos, tiny shimmering globules are seen on the points of hair, wool, sponge, fibre, &c., projecting from the surface of the fæces or agar.

The polyps occupy specially the prominent points of earth, fæces, or whatever they may be on. They are evidently on the look-out for something. They transfer themselves to most things that touch them, fingers or what not, but do not invariably do so—they often shrink back when touched. If a sprig of grass be planted in the fæces some of them will find their way up it and continue waving about until they are dried up, but they do not take to grass in preference to anything else. If a cotton strand be wetted and placed with one end on the fæces and the other in a capsule of wet earth, many of the embryos will travel along this bridge to the earth. But the bulk of them will get to the highest point of the cotton bridge and there form petals, &c. When the cotton dries the petal dries into a horny, motionless filament, and remains erect. Pushed about with a needle it still adheres to the cotton. Moisten the cotton, and in a few minutes the petal is waving again. So these embryos stand drying; but I do not know for how long.

Whatever else they may be, the polyps are certainly travellers. In the media they move more rapidly than the breeding forms;

but they only travel where there is moisture, though the amount of moisture required is very slight. In a watch-glassful of fæces they formed a fringe round the edge of the glass. They may be seen waving from the spines or bodies of maggots, on which they are sometimes carried about. If the tin or other vessel in which the parents are living has been wetted by the maggots getting out and wandering about, the travellers will be all over the tin or vessel. In a very humid atmosphere they may get outside a Petri dish, and they are commonly seen on the inner side of the dish, above the agar, waving about at right angles to the surface of the glass. It is easy for the careless observer to get them on his fingers. Polyps have been noted on the surface of a portion of the fæces for as long as two months. They appeared in remote subcultures from an agar plate which had been derived from fæces two months old. They will adhere to a common fly just as they will to a needle; but they display no special predilection for the fly.

I planted polyps on agar and in water, and failed to get an increase; but I am not yet sure whether or no they can take on parental functions as a free form.

Salt Affects the Embryos Unfavourably.

Normal salt solution crinkles travellers in a few moments, and they die: $\frac{1}{1000}$ $HgCl_2$ also kills them, so do carbolic solution, lysol, &c., and no doubt other disinfectants do the same.

Agglutination of Travellers.

Sometimes when suddenly transferred from another medium to water the filariform embryos agglutinate. They do so also when placed in ·2 per cent. hydrochloric acid,[1] but they often recover from this state. There are two ways of agglutinating. A couple of embryos may be seen to have their tails twisted together—the terminal filament, that is; they struggle vainly to get loose and they are apt to die in this position (fig. 12). In other cases a clump of a dozen, more or less, may be stuck together, each of them lashing about and doing his best to get free, but as soon as an embryo gets loose in one part it is stuck in another (fig. 12). The appearance suggests a cluster of bird-limed snakes. Occasionally a group of

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[1] It seems likely, therefore, that they would agglutinate in the healthy stomach, but it does not follow that the stomach is an unsuitable avenue of entry, for it might be that the action of the stomach juices assists development.

dead embryos may be seen side by side, adhering in their whole length (fig. 12).

Effect of Environment on the Form of the Organism.

The size and appearance of the organisms vary a good deal. There is some evidence that they may become short-tailed, or rather tailless, and be brought back to the tailed condition by suitable nutriment. Probably temperature and nutriment are concerned in this.

The Organisms can Exist on Articles of Human Food.

Travellers were placed on a piece of bread; three days afterwards, on moistening the bread, they were seen waving from its surface.

On a piece of ripe banana they could be seen alive up to the seventh day.

On Ideal milk the breeding forms flourished and reproduced their kind, in spite of the milk having turned acid.

Planted on potted ham they died quickly. On potted chicken they wandered about for a time, but died in a few hours without having bred. In these substances the salt would no doubt be fatal to the organisms.

On cold beef they grew well and bred freely for some days, the beef in the meantime having become putrid.

Doubts—Adverse Experiments.

So far all has been plain sailing. *There* are the ankylostomal fæces and *there* are the breeding free forms, &c. What more can be wanted? The shrewd guesses of one or two writers that a free form exists are borne out, it seems, by facts.

But after all it is only a *post hoc* assumption that the organisms described really come from ankylostomes. The reader must have noticed the curious fact that though the embryos in water lived happily enough, they did not take on parental functions; also that the fæces which produced the breeding forms had been exposed to the air. To prove the case it is necessary to obtain the free form from the uncontaminated ovum of the adult parasite. Moreover, the experiment must be done in such a way that no travelling worm could crawl into the medium.

Experiments.—Ova were placed on agar in a Petri dish. The dish, wrapped up in cotton-wool and linen cloths, was kept in a closed box in an atmosphere of napthalein. Some embryos appeared in the course of twenty-four hours, others appeared from time to

time, but *no breeding took place, and the embryos did not develop sexual markings. I am brought to the ground again.*

Fæces containing ova were taken direct from the intestine of a killed animal and placed in a dish as above. The result was the same. The embryos remained asexual and wandered about in the agar day after day till they died.

Dishes of agar containing ova alone and fresh fæces full of ova respectively were isolated in a dish of malodorous disinfecting fluid. Again no breeding forms appeared.

Ova-containing fæces direct from the intestine were placed in an air-tight tin. Only asexual embryos were found in the fæces.[1]

Control preparations infected with breeding forms flourished when packed away as described above.

These failures, then, were not due to want of light and air. They may be explained as follows :—

An Insect Host of the Worm found in Fæces.
The "Grey Fly."

There is an insect about the size of a small flea, and of very active running movements, which haunts fæces and decaying organic matter of various kinds.

The male has wings and can fly, the female has no wings.

The eggs are white, oval and longitudinally striate. By prolongation of the hinder parts of the abdomen the mother can deposit eggs in places to which she herself is too big to gain access.

The larva is a maggot which moves actively, wandering about ceaselessly, and, in moist media, trailing behind it a tube of intestine several times the length of the maggot. It can travel rapidly on a dry surface also, as across a table or floor.

The pupa is merely the maggot hardened and deepened in colour to a light brown.

The insect is of a dull white colour, changing to light brown on the legs, thorax and head. There are four broad rectangular bands of deep brown on the upper surface of the abdomen, diminishing in size from front to rear ; a fifth mark is a small, irregular, or half-moon-shaped transverse band. In general appearance to the naked eye the insect is chequered grey. I call it for convenience the

[1] By the term "asexual" I mean non-breeding, without regard to the rudimentary V spot and the tail dot sometimes seen, and which I take to indicate the future sex of the embryo.

"Grey Fly." The stages of development are: ova one to two days, larva five to six days, pupa eleven days, varying on both sides, say fifteen to twenty days from fly to fly.

Both sexes of this little insect are able to carry about embryos which develop into breeding forms in suitable nutrient material (figs. 17, 18 and 19). I have recovered as many as ten lively embryos from one insect. The insect is capable of infecting organic matter with the breeding forms already described (fig. 20).

Specimens of the "Grey Fly" were sent to the British Museum. The following is Mr. E. E. Austen's letter concerning them:—

[*Copy.*]

"British Museum (Natural History),
"Cromwell Road, London,
"*October* 20th, 1904.

"Dear Bruce,—The insects sent by you for identification to Professor Lankester, and forwarded from Sierra Leone by Major Smith, who believes that they convey the parasite of ankylostomiasis, are wingless females of a dipteron, belonging to the family *Phoridæ*. The species is new and probably the genus also, though possibly the insect might be referred to the genus *Stethopathus*, Wandolleck, to which, in any case, it is very closely allied. Before the species can be named a description of it will, of course, have to be published. If necessary, this can be done at once; but since there are objections to founding a new species, and especially a new genus upon the female alone, further material would be desirable for the purpose, including, if possible, specimens of the male, which is very probably winged.[1]

"The single species of which the genus *Stethopathus* at present consists was described from specimens found on carrion at Ralum, New Britain (Oceania), but an allied form occurs in Liberia, and is said to be an ectoparasite of land-snails. It is somewhat remarkable, however, that Major Smith's species presents a much closer resemblance to *Stethopathus ocellatus*, Wandolleck, from New Britain, than to the Liberian species.

"Many *Phoridæ* frequent decaying animal and vegetable matter, and some years ago a case occurred in Burma in which the larvæ of one species were discharged in large numbers from the human

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[1] This proved to be the case—the males have wings.

intestine.[1] If Major Smith's specimens were derived from excrement containing *Ankylostoma* eggs, it would not be surprising that embryos should be found in them, but one would scarcely expect that a small apterous insect of this kind would be a very efficient disseminator. It is not a blood-sucker, and so at most could only be a mechanical carrier.

"Yours sincerely,

"(*Sd.*) ERNEST E. AUSTEN.

"Colonel D. BRUCE, F.R.S., R.A.M.C.,
68, *Victoria Street, S.W.*"

Experiment.—A number of the insects were induced to go from some material containing the parent organisms to a sterile agar plate. The plate was then isolated. In two days the plate already contained adult worms of both sexes, and they bred in the fashion before detailed. The experiment was repeated with like result and again with negative result. In the latter case we may assume that the flies happened to be uninfected. Agar plates were also left in the neighbourhood of flies, and some of the plates became infected.[2]

The embryos are inside and not merely upon the insect. They appear to be coiled up in a group at the junction of the thorax and abdomen, just inside the anterior portion of the abdomen. How do they get there? By entering the body of the larval form of the insect—here I found them lying quite motionless (figs. 13, 14, 15 and 16). The embryos obtained from the adult insect may be motionless, or show signs of life when placed in water, or be very active. Sometimes they are crinkled as though they had been pressed together; these may fill out and become active when placed in water (fig. 17). In the pupa of the insect the embryos have been seen, sometimes active, moving about as though desirous of escaping from their prison, at other times motionless.

The insect is the host of the worm which I am dealing with. It is not the only one, for I have already discovered a small black fly and a large white one which carry a worm resembling those described. The females of the "black fly" and the "white fly" have wings.

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[1] The fly likes cold meat. In Sierra Leone it deposited its ova on meat; it also infected the meat with the worms which I have been describing.

[2] It must have been in this way that the old water preparation, mentioned under "Cultivation in Water," became infected.

It does not seem to be necessary for each generation of the organism to pass through the host. I have carried on subcultures on agar to the sixth degree without aid from the insect, and there is no apparent diminution in the number of worms in each successive culture. It is just possible, however, that tardy hatching of some of the eggs of the original free worms accounts for the growth in the subcultures. The organisms increase with great rapidity, each female laying a score or two of eggs, and a generation maturing in less than two days.

The host, being constantly on the move in search of food, ensures the transference of the organisms from place to place. The insect, as it flits from one fæcal deposit to another (always abandoning the old fæces for an attractive new deposit), leaves its ova behind it, thus providing the necessary maggots to become infected. The maggots in their turn pass on the embryos to the imagines, which carry them to fresh feeding grounds of fæces or other organic matter. Here the parent worms will produce the travellers as well as a new generation of breeding forms to go through the same cycle again.

How does the embryo gain access to the body of the maggot? Probably through the skin of the maggot.

How does the embryo get out of the fly? Probably through the skin (if I may so term it) of the fly.

When the fly is stretched so that the thorax and abdomen are pulled apart, the junction between these two portions of the insect's anatomy is seen to be very thin and diaphanous. It ruptures with the slightest pressure and the embryos come out—probably they can bore their own way through it.

Infection does not seem to be by the ova of the fly. Ova were collected, washed and placed in agar plates. They became maggots which duly passed on to the pupa stage. The agar remained uninfected. I have repeated this several times with similar negative result. Moreover, I have placed an individual dissected fly and its lately contained embryos on agar, with the result that the embryos grew into parents and bred just as well as if they had passed from the iving fly to the agar in a natural manner (fig. 20).

DIAGRAMMATIC REPRESENTATIONS OF STAGES IN THE LIFE OF THE WORM WHICH IS FOUND IN ANKYLOSTOMAL FÆCES (THE DIAGRAMS ARE NOT DRAWN TO SCALE).

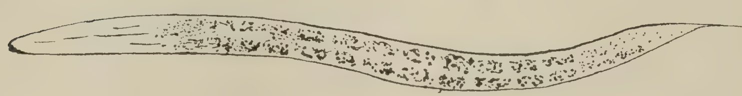


FIG. 1.—Young embryo (from dog fæces), as seen under a two-thirds objective, but much enlarged.

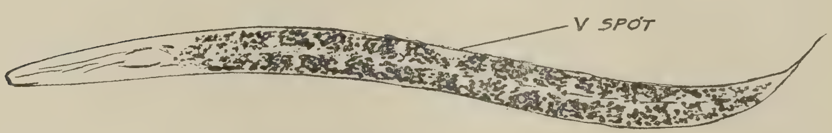


FIG. 2.—Indication of sex (from dog fæces).

FIG. 3.—Half-grown worm (from dog fæces).

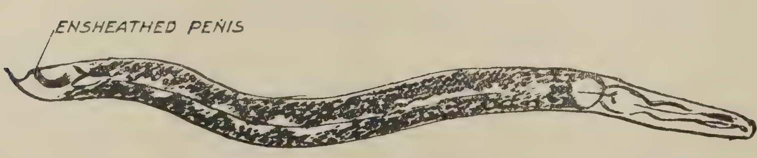


FIG. 4.—Male worm (from fæces of dog). The figure shows the male a little larger than it really is, relative to the size of the female.

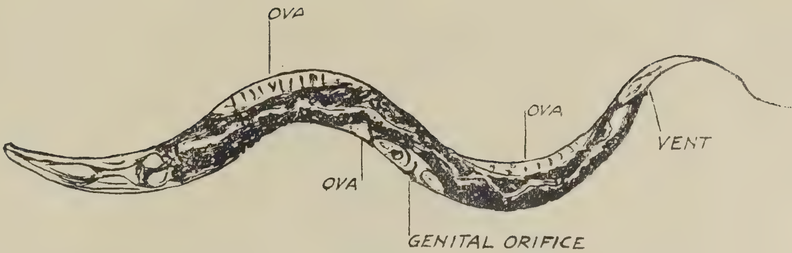


FIG. 5.—Full-grown female (from dog fæces).

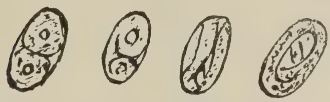


FIG 5A.—New-laid eggs and older ones.

FIG 6A.—Head on larger scale.

FIG. 6.—Full-grown female (from human fæces).

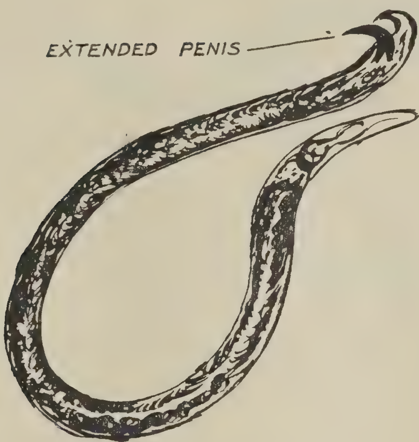


FIG. 7.—Dead male (from fæces of man).

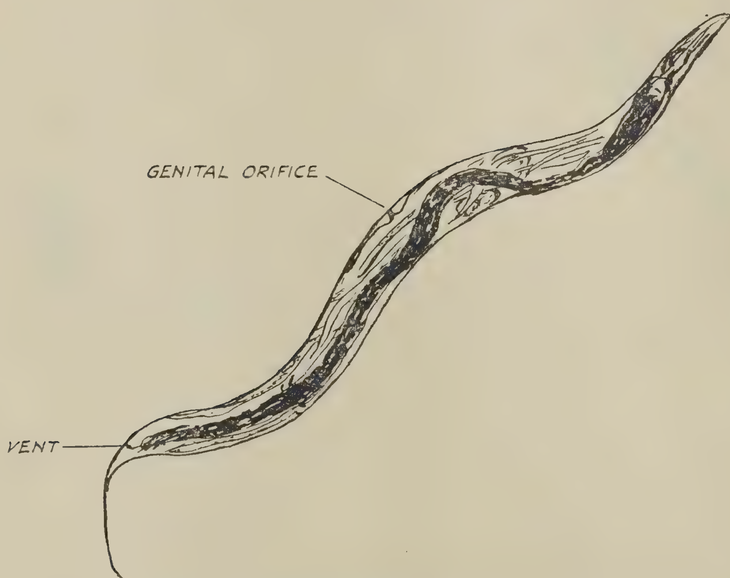


FIG. 8.—Female, containing an egg and many free embryos (from human fæces).

FIG. 9.—Dead female—one embryo-containing egg, and one free embryo still alive in the body-case (from human fæces).

FIG. 10.—Embryos waving about on the surface of fæces (as seen under a hand lens).

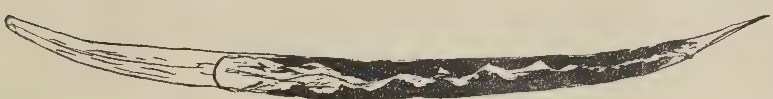


FIG. 11.—Young "traveller" from agar culture off dog fæces.

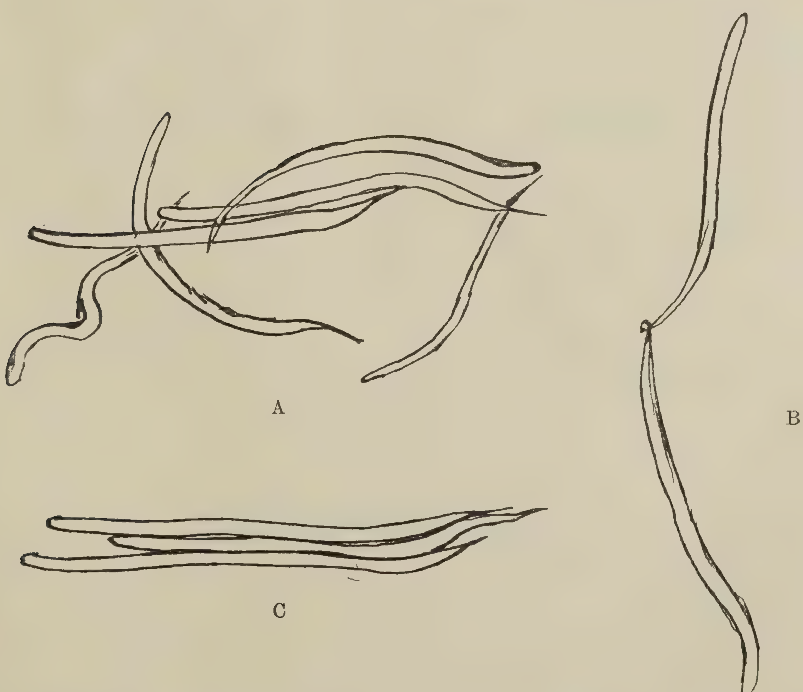


FIG. 12.—"Travellers" agglutinating. A, in HCl. (dil.); B., in water; C, in watery agar (in C the embryos are motionless—dead).

Fig. 13.

Fig. 14.

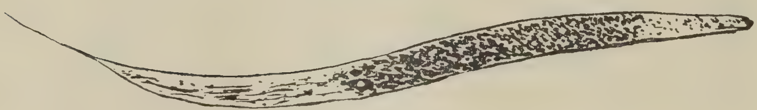


Fig. 15.

Fig. 16.

Figs. 13, 14, 15, 16.—Embryos from the body of the larval host, all motionless; the first three (from one maggot) show granular matter and fatty-looking globules gathered towards the middle of the worm.

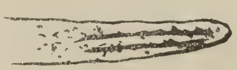


Fig. 16a.—Head of embryo shown in fig. 16, under $\frac{1}{12}$ oil immersion.

Fig. 17.

Fig. 18.

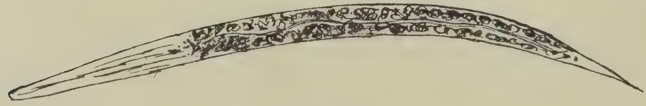


Fig. 19.

Figs. 17, 18, 19.—Types of embryos from the body of the "grey fly."

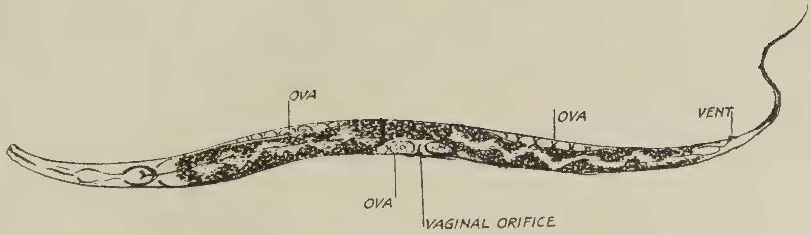


FIG. 20.—The embryo (fig. 19) as it was seen in agar the day after extrusion from the fly. (The worm was, of course, much larger than it appears in this figure in relation to figs. 17, 18, and 19.)

The position then is: A worm, breeding in ankylostomal fæces —a worm which in the embryo stage resembles the embryo of the ankylostome—is in reality a parasite of the "grey fly."

The question arises: Is the worm a parasite of the "grey fly" and nothing more, or is the fly an alternative host of the ankylostome of man or any lower animal?

The following experiment has been carried out twice: Ova of the "grey fly" were placed on an agar plate containing adult ankylostomes with their eggs and some newly-hatched embryos. The plate was enveloped in wool and not opened till the maggots from the ova of the fly had become pupæ. Pupæ were then dissected and a small proportion were found to contain embryos. There were no breeding worms in the agar. Some of the pupæ were kept till the flies emerged, and among these flies were some which contained worms such as those previously described. Unless the parasite is hereditary in the fly—passes, that is to say, through the ova—the embryos obtained from the above-mentioned pupæ and flies must have been ankylostomal in origin. I have, however, not been able as yet to satisfy myself that the parasite is not hereditary.

The conclusive evidence required is, infection of an animal with ankylostomes by means of the embryos of the free-living organism. The following is an account of experiments in search of this evidence.

(To be continued.)

Clinical Notes.

A CASE OF ABSCESS OF CEREBELLUM, SECONDARY TO ABSCESS OF THE LIVER.

By Major J. B. BUCHANAN.
Royal Army Medical Corps.

No. 20487, Gunner W. M., 85th Company R.G.A., aged 27, was transferred to the Station Hospital, Darjeeling, April 4th, 1903, from the Station Hospital, Barrackpore, with "simple continued fever." His transfer certificate showed that he had been in hospital since April 6th, with fever of an irregular type. His blood had given a negative reaction to Widal's test. He had latterly somewhat improved, and was transferred to Darjeeling.

On arrival here he was emaciated and weak, but was able to walk. His complexion had a sallow tinge. His temperature in the evening showed a slight rise to 99°. He complained of no pain over the liver, but there was slight enlargement downwards. After a few days the evening rise of temperature became more pronounced, and he had attacks of diarrhœa in the early mornings, in which were traces of blood and mucus. It was suspected to be a case of abscess of the liver, and it was decided to explore that organ.

On April 18th, before any operation was performed, he complained of very severe pain over the frontal and occipital regions, and everything failed to give relief.

On April 21st he commenced to have attacks of cerebral vomiting, and during the night passed into a state of coma, in which he died early in the morning of the 22nd.

Autopsy, twenty hours after death. *Rigor mortis* was well marked, and there was considerable emaciation. The heart and lungs were normal, with the exception of some congestion at base of right lung.

Abdomen.—On opening the abdomen the liver was seen to be enlarged and pushed downwards. It presented a flattened appearance, and the upper surface was adherent to the diaphragm. It weighed 5 lbs. A large single abscess was found in the upper part of the right lobe, containing a pint of pus. The abscess was surrounded by a fibrous capsule.

Stomach.—The mucous membrane was congested.

Intestines.—The mucous membrane of the small intestine was congested. In the large intestine there were several large circular ulcers, some cicatrised, some healing, and others in an advanced stage of

ulceration. The ulcers extended throughout the whole length of the large intestines.

Brain. — The brain weighed 3 lbs. 1 oz. The dura mater was adherent on both sides of longitudinal sinus, in post parietal and occipital regions. The surface veins were engorged. Section showed general congestion. In the left lobe of the cerebellum an abscess, the size of a walnut, containing dark-coloured pus, was found.

This is an interesting case of an abscess of cerebellum, secondary to abscess of liver. The abscess of liver was due to dysentery, and, although the autopsy revealed extensive ulceration of large intestines, the symptoms of dysentery during life were not very pronounced. The abscess of liver was probably of old standing, as shown by the containing capsule of fibrous tissue.

AN UNUSUAL CASE OF MUSCULAR DYSTROPHY.

By Lieutenant W. C. RIVERS.

Royal Army Medical Corps.

Private R., aged 31, of medium height and build, came to hospital complaining of weakness of the legs, and when one looked at them his calves appeared very thick and the thighs just as thin. Of this condition he gave the following history: Since coming to the station from Poona, seventeen months ago, he had been getting thinner "all over," but especially in the thighs. Some two and a half months back, when his thighs were already unusually small, he noticed a feeling of numbness and loss of power in the legs after standing on parade, while at the same time his calves grew thicker and walking taxed him, particularly when going up steps. He says that the swelling of the calves would subside a little after rest.

The man's family history contained nothing of interest, except that his mother, a field worker, died insane at the age of 45, and with a weakness of the hands, caused, he said, by rheumatism. His medical history sheet showed admissions for gonorrhœa repeatedly, and for chancroid, but there was no mention of syphilis. The above symptoms were the whole of his trouble, the general health remaining good. He was a marksman.

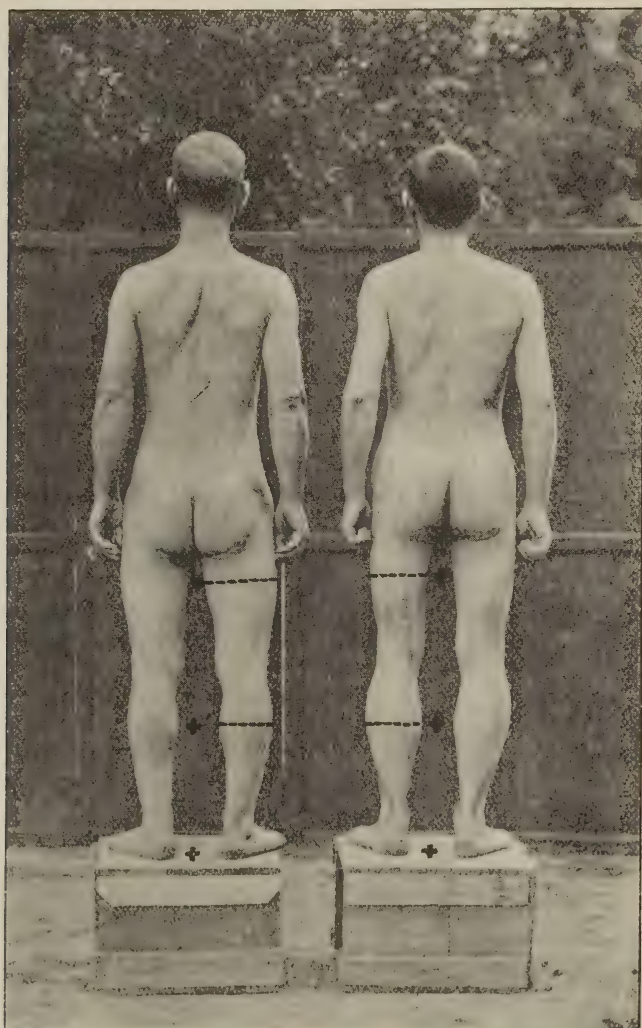
On examination of the nervous and muscular systems the following abnormalities were found:—

Motors.—Paresis of all muscles of the legs below the buttocks. This seemed fairly uniform, but the patient himself thought the hamstrings the weakest.

Muscular dystrophy.—Distributed roughly as atrophic in the thighs, and "preliminary-hypertrophic," or more likely "pseudo-hypertrophic," in the lower legs. The measurements were (maximum): Right calf 16, thigh $17\frac{1}{2}$; left $15\frac{3}{4}$, $17\frac{1}{2}$. His gait is rather shuffling.

Sensory.—Dysæsthesia. He complains of a tingling over the back of the calves on getting out of bed in the morning, which disappears later on.

Reflexes.—Superficial, rather active. Deep absent. The ocular reflexes very rapid.



Electrical Reactions.—Not ascertained, as no diagnostic apparatus was available. To a "magneto-electric" machine, however, the enlarged and wasted muscles responded fairly alike, with rather *diminished con-*

tractions. Stimulation of a subcutaneous nerve trunk produced due contraction of its dependent group of muscles, and there was no loss of electrical sensation.

Treatment, including the administration of mercury, gave no improvement. Three months from the date of first being seen he was just as weak as ever, although, while the thighs remained unaltered, the calves were less by half-an-inch. The case was diagnosed as idiopathic muscular atrophy, or more learnedly, adult symmetrical progressive muscular dystrophy of Erb. The two symptoms above mentioned, which pointed to a local inflammatory process in the lower leg muscles, seemed especially interesting; in fact, the diagnosis was fairly obvious but for two things; for, in the first place, Erb does not mention a pseudo-hypertrophic form of the disease in adults. This man's big calves may have been the result of the hypertrophy of muscular bundles, which is an early stage of the pathological process going on in ordinary idiopathic muscular atrophy; but then, how is their great weakness to be accounted for, and their loss of electrical excitability, as also the statement, if a lay one, that the thighs were never larger than normal? Secondly, text-books seem to agree that muscular dystrophy is very generally found not to co-exist with disease of the nervous system. The claim which this case has to be considered exceptional in this respect rests, of course, on the explanation of absent knee-jerks as due to an interrupted reflex arc, and not to loss of myotatic irritability by wasted extensor muscles.

On both these scores the case seemed worth recording, although possibly a neurologist, with his special clinical experience, might see little about it that was unusual.

For an excellent photograph (in which, for contrast's sake, there figures beside the patient a man of similar size) I have to thank Lieutenant-Colonel Winter, R.A.M.C.

TRANSFUSION.

By Captain J. C. RUTHERFORD.
Royal Army Medical Corps.

At 7.30 a.m., on the morning of November 1st, I was summoned to the Castle, Cape Town, to see Private M., of the 1st Battalion D.C.L.I., who had attempted to commit suicide. He had made a determined effort, or rather series of efforts, with his razor, and though he had missed the carotids, had succeeded in inflicting six deep irregular gashes in the throat; one incision had gone into the trachea. After inflicting the injuries described, the man had walked up and down the barrack-room and kept off his comrades by striking at them with the razor until he fell exhausted. The wound was packed with gauze and firmly bandaged. The collapse from loss of blood was extreme, he lay pulseless, and it was

apparent no time was to be lost in attempting to pull him round. We obtained a transfusion apparatus with little loss of time, and sending post-haste to the officers' mess for a jug of boiling water, diluted it with cold to about blood heat, and roughly measured out common salt, one drachm to the pint. By this time the patient's condition seemed almost hopeless. With a hurried clean up, I exposed the posterior median vein, and assisted by Dr. Huey, poured in 105 ozs. To our intense relief we got the pulse going, and when our patient had the full 105 ozs. his change of condition was wonderful. From what looked a moribund state had been exchanged for one that enabled us, an hour and a half later, to have him transferred by ambulance-waggon ten miles to Wynberg Hospital. The subsequent progress of the case was uneventful.

I venture to note this case, as the little operation of transfusion had to be carried out in such a hurry, that the niceties of precaution were neglected, and I remember noting, with an uncomfortable feeling, the very apparent presence of foreign particles floating about in the water, as could be seen in the glass funnel; the quantity used was large, and the recovery rapid enough and lasting to enable the patient to be driven ten miles by ambulance waggon shortly afterwards.

A CASE OF TRAUMATIC CATARACT, DUE TO LIGHTNING STROKE.

By Major J. C. MORGAN.
Royal Army Medical Corps.

The notes of the following case may prove of sufficient interest, in as much as the injury is a rare one, to merit record in the columns of the Corps Journal. Major Yarr, R.A.M.C., in his "Manual of Military Ophthalmology," page 178, quotes nine cases as having been recorded of cataract due to lightning stroke.

Private C., aged 22, service four years, enlisted on April 20th, 1900, when, he states, his eyesight was quite good, and he read the "test dots" easily. On January 8th, 1902, he was encamped with his regiment on Proclamation Hill, outside Pretoria, when the tent next to that in which he was was struck by lightning, and two men killed in it. Patient and another man in the same tent with him were struck by the flash and were quite blind and unable to see anything for some days. Patient was admitted to hospital for treatment, and on his discharge some three weeks later he could see all right with the right eye, but could not see to read a book with the left. He further states that he was repeatedly examined by the medical officers at the hospital with the ophthalmoscope, but that they could not find any cause there for his loss of sight. Subsequently, he was again admitted to hospital at Charlestown, on March 12th,

1902, and was two and a half months under treatment. He states that on this occasion he was again examined by the medical officers, who noted "small black dots coming in the lens," and told him that he might possibly develop a cataract. Patient eventually reached Malta, and in August, 1903, was again admitted to hospital. At this time his eye had a dull glaze all over it. He landed in India, October, 1903, and reported sick, June 25th, 1904, when the condition of his eyes was as follows:—

$$\text{V.A.} = \text{R. } \tfrac{6}{60} + 2 \text{ D.} = \tfrac{6}{15}.$$

L. Finger movements only.

Retinoscopy.

R.	+ 2·50
	+ 3·0

The right disc is normal in appearance, though there is a well-defined ring of pigment round it, indicative of some retino-choroiditis. Media clear, and no signs of any changes in this lens.

A cataract is forming in the left lens, and the disc cannot be seen.

Patient states he has never had syphilis, nor can any other cause be assigned for his condition.

AN UNUSUAL CASE OF DISLOCATION OF THE CLAVICLE.

By Lieutenant E. V. AYLEN.
Royal Army Medical Corps.

The following case which was under my care may be worth recording, as I believe the injury is of infrequent occurrence.

The patient, who is a subaltern in the Chinese Regiment, was pulling up his pony after the finish of a "polo scurry," when the pony fell, owing to his rider trying to turn him suddenly to avoid some spectators who were trying to cross the ground. The officer was pitched violently out of the saddle and fell heavily, alighting, apparently, on the back of the right shoulder. I was riding in the race myself, and so was enabled to examine the officer immediately. However, I could merely ascertain that no fracture had occurred, as the pain was too great to allow the parts to be manipulated. The officer evinced symptoms of faintness, so he was conveyed to his quarters on a stretcher.

There an anæsthetic was administered, and it was found that the outer end of the right clavicle had been dislocated upwards and backwards from the acromion process of the scapula. The deformity was very marked, an interval of quite two inches intervening between the outer end of the clavicle and the acromion.

The acromio-clavicular ligaments must have been completely ruptured, and probably also the conoid and trapezoid ligaments.

The shoulder was put up temporarily by Sayre's method, and four days later I applied a poro-plastic felt cap over the dislocated clavicle,

extending well down both anteriorly and posteriorly; traction was made on this in a downward direction by a vertical strap, which was maintained in position in front and behind by being fastened to a cross strap which went entirely round the chest. The elbow was at the same time supported by a broad piece of strapping extending over the opposite shoulder. By this means the deformity was almost entirely corrected, though, of course, the straps needed continual readjustment.

On the sixth day after the accident I took the patient on board H.M.S. "Glory," where, by the kindness of Dr. J. G. Wallis, R.N., a skiagram was taken which served to confirm the diagnosis. The apparatus was kept on for three weeks; it was then discontinued, the elbow being still supported by strapping and the arm bandaged lightly to the side. At the end of the fourth week I employed passive movements and massage, which was carried out by a Japanese under my direction.

The officer returned to duty forty-five days after the accident, the clavicle being then in good position, though a space of half an inch still intervened between it and the acromion. He was able to move his arm freely without pain, and to raise it well above his head. In the middle of September, ten weeks after the accident, the officer was riding at the Chefoo race-meeting.

BRIEF ACCOUNT OF A CASE OF ADDISON'S DISEASE.

By Major C. T. BLACKWELL.
Royal Army Medical Corps.

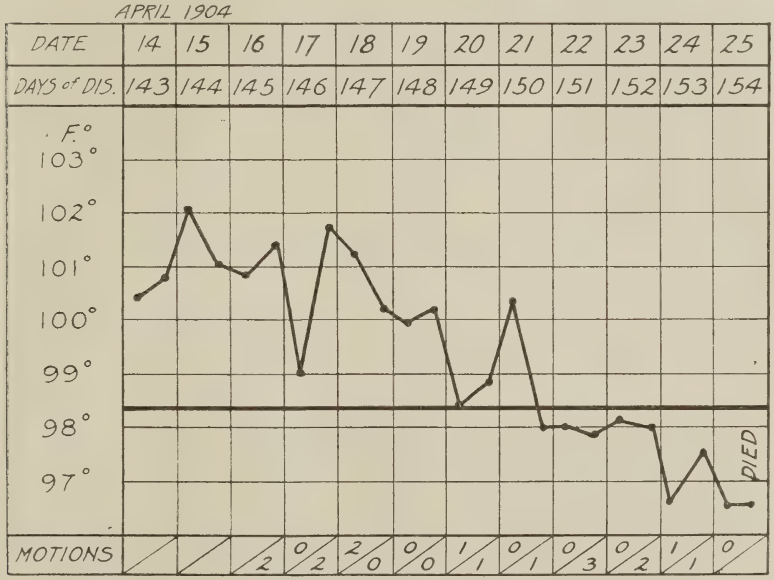
April 8th, 1904.—Corporal J. R., of 1st Battalion Leicestershire Regiment, arrived at the Royal Victoria Hospital on March 30th, 1904.

History.—Patient was stationed at Bellary, India, and on February 24th, 1904, was brought before an Invaliding Board, and was recommended for change to England. The medical officer in charge of the case on that date states that the commencement of the illness dated back three months, and that during that period patient had been gradually getting weaker and unfit for exertion of any kind, and that he was admitted into hospital at Bellary on February 3rd, 1904. At first there was some fever of irregular type. On the above date (February 24th) there was deep browning of the face, and the colour was well marked on all exposed parts, and also on the genital organs, and patient stated that the colour had been present for three months, and that during that time he had lost flesh considerably.

There were patches of deeper-coloured pigment on the forehead and ears, and pigment was also deposited on the mucous membrane of the lips and cheeks. On the body, which was uniformly darker than natural, there were patches of darker colour, especially where pressure was usual,

such as on the shoulders from braces, and at the place where a belt would press on the back; there were also a few patches on the legs and buttocks.

He was getting thinner, and complained of nausea, vomiting, and headache—the latter was persistent—and also of dimness of vision. Pain in the loins was felt occasionally, and deep pressure in the right lumbar region caused pain. Great fatigue was the result of any exertion. He always had a tired, weary expression. The first sound of the heart was reduplicated. There was no evidence of tubercle in any other organ.



He embarked at Bombay on board the s.s. "Plassy" on March 7th, 1904. The medical officer on board remarked that the discolouration of patient's skin remained about the same, that his general health had improved, and that he had gained in weight during the voyage. Patient was transferred to Netley on March 30th, 1904.

Present Condition.—The novelette description, "bronzed by an eastern sun" was appropriate to patient's appearance; the colour was light sepia, and was uniform and not patchy, as described above; the skin of entire body was uniformly dark, and that on the genitals was very dark. Patient said that the dark patches had disappeared during the voyage. His face was somewhat thin, but his body was well nourished. He complained of being easily fatigued, and was disinclined for any exertion. He took his food well, and went out into the grounds whenever

it was fine. His liver was slightly enlarged; his spleen was normal. Heart's action was normal, and his temperature was normal. He said that he sometimes had an aching pain in left loin; that he had enjoyed good health in India previous to this illness, and that this had come on gradually. He was anxious to leave hospital, and was brought before the final Invaliding Board to-day (April 8th), for discharge from the Service.

April 17th.—On the morning of the 14th instant, patient did not feel well, and remained in bed. He complained of sickness and increased weakness; he said that he had had two attacks before of sickness, and he thought it was only temporary indisposition. He had slight fever. On April 15th and 16th the sickness was very persistent, and nearly all food caused vomiting. This morning patient is much better, and he prefers to sit in front of the fire to remaining in bed. Nausea is very much less, and his temperature is 99° F.

April 19th.—On the evening of the 17th instant patient's temperature rose again, and sickness again became severe; vomiting was very persistent, and was only slightly checked by treatment; pulse is much weaker, and heart's action is rapid.

April 22nd.—Sickness is not so troublesome, but patient is much weaker: he complains only of weakness, and has no pains. Temperature is normal.

April 24th.—Patient is able to take a fair amount of nourishment and stimulants, but the weakness is greater; pulse is softer and more rapid.

April 25th.—Patient died to-day.

Treatment was directed to allay the vomiting, and stimulants, digitalis and strychnine, were given to sustain the heart's action.

Post-mortem examination made by Lieutenant H. H. J. Fawcett, R.A.M.C., twenty-four hours after death:—

External Appearance.—Rigor mortis present. *Post-mortem* staining present. Body well nourished. Pigmentation of a greenish-brown colour present all over the body, most marked on the genitals, which were of a dark brown colour.

Internal Organs.—Heart, 9 ozs.; valves and muscles normal.

Lungs.—Right, 20 ozs.; pleura adherent throughout. Left, 24 ozs.; apex somewhat congested. Structure of both lungs was normal.

Liver.—Sixty-three ozs., congested; fibrous adhesions on upper surface.

Spleen.—Five and a half ozs., normal; adherent to gut.

Kidneys.—Right, 8 ozs.; left, 7½ ozs. Both congested. Suprarenal capsules on both sides enlarged and hard. On section they were fibrous, with small calcareous patches throughout; no signs of caseation.

Pancreas.—Normal.

Intestines.—No signs of pigmentation; a few mesenteric glands enlarged and dark coloured. Thymus present. Scrapings from suprarenal capsules were examined for tubercle bacilli, but none were found.

[A suprarenal body and portion of a kidney from a case of Addison's disease were received by us from Netley for examination. The suprarenal body was enlarged and of a light yellow colour, and as hard as a stone. The upper portion was calcareous ; the lower caseous.

Small portions of the caseous material were smeared on slides and stained to demonstrate tubercle bacilli, but without success. Nor could any cellular elements be made out in these smears. Sections were cut through the entire thickness of the body and stained by various methods ; from these it was evident that the suprarenal body was the seat of a complete caseous degeneration, followed in the upper and thinner portion by calcareous infiltration. No organised structure remained, nor could any tubercle bacilli or other pathogenic organisms be found. Sections were cut from the portion of kidney attached, but no pathological alteration was found. The semilunar ganglia could not be made out in the matted tissue around the suprarenal body. D. Harvey, *Captain*, *R.A.M.C.*]

A FATAL CASE OF EMBOLISM OF THE PULMONARY ARTERY AFTER THE OPERATION OF EXCISION OF VARICOSE VEINS.

By Lieutenant-Colonel G. H. SYLVESTER.
Royal Army Medical Corps.

The patient, a powerful man, aged 34, was admitted March 9th, 1904. He had suffered from varicose veins in both legs for several years, but during the last twelve months they had become much worse, seriously interfering with the performance of his duties. On the right side the enlarged veins were all below the knee, but on the left the internal saphenous in the thigh was also affected. He was in good health ; no visceral disease could be discovered.

The usual operation was done on March 28th, six bunches of dilated veins being excised, including three inches of the middle of the left saphenous in the thigh. The patient's temperature did not rise above normal after the operation, and the stitches were taken out on the twelfth day, when, except for two places where the edges had been disturbed in taking off the dressings, the wounds were healed. The splints, which had been worn since the operation, were not reapplied, but thick dressings were bandaged on from the foot to the groin on both sides.

That night he suddenly sat up in bed, complained of feeling faint, fell back and died almost immediately.

Post mortem.—The pulmonary artery was found blocked at its bifurcation by a firm dark-coloured clot.

The organs generally were healthy, the spleen only being slightly enlarged. There were no clots in the iliac veins. Circumstances did not allow of the leg veins being examined.

I have been unable to find any information as to how often embolism occurs after this operation, but it must be very rare. The case, however, shows the advisability of keeping the splints on till the patient is allowed up at the third week, when every precaution to prevent such an unfortunate occurrence will have been taken.

A CASE OF ABSCESS OF THE LIVER, COMPLICATED BY A BILIARY FISTULA AFTER OPERATION.

By Captain H. ENSOR, D.S.O.
Royal Army Medical Corps.

At Kassala, Private N. S., a soldier of the 11th Sudanese Battalion, was admitted to hospital on October 3rd, 1903, suffering from fever. In addition to the malaise caused by the fever, he also complained of a feeling of discomfort in his right side. On examination, both liver and spleen were found to be considerably enlarged, but neither organ was sensitive to pressure, and the enlargement of the liver was uniform. He positively denied ever having had dysentery, and his medical history sheet supported this statement, so far as his military service was concerned, a period of four years. His medical history sheet recorded two admissions for intermittent fever. The blood was examined microscopically and the small ringed form of parasites were discovered. The presence of these malarial parasites, and the fact that the man's liver and spleen were both enlarged, the former organ uniformly, made it probable that the man was suffering from double malignant tertian fever, complicated by enlargement of the liver and spleen. This fever is much the most common type of malaria met with in the Kassala province. I may also remark here that enlargement of the liver is common among the Sudanese, probably as a result of their habit of drinking large quantities of *marissa*, a native beer made from fermented dhurra, and also as a result of chronic malarial poisoning. The patient was put on the usual treatment for malarial fever, a calomel purge, and quin. sulph., grs. x., three times a day. Under this treatment the man's condition steadily improved, and the temperature on the evening of October 11th fell to normal; but he still, however, admitted a feeling of fulness in his right side on questioning. On October 13th his quinine was limited to one dose of grs. x., in the early morning, and an arsenic and iron tonic was ordered for him, it being anticipated that he would be discharged from hospital in a few days. On the evening of October 17th he complained of very great pain in his right side, and his temperature rose to 101·5° F. Examination showed some tenderness of the liver, but nothing in the way of any localised enlargement, and he stated that the pain had come on quite suddenly during the afternoon of the same day; he volunteered no statement of any pain in his right shoulder. The next morning his temperature was still

raised, and his conjunctivæ had a slight icteric tinge ; the gall-bladder was not palpable. The patient was anæsthetised, and the liver explored with an aspirating needle, with the result that on the third puncture a deep-seated abscess was discovered in the right lobe, the needle having been inserted through the seventh intercostal space in the mid-axillary line and directed inwards and upwards. An incision was then made over his eighth rib, about one and a half inches behind the mid-axillary line. About one inch of rib was excised, and the abscess opened by means of an incision into the liver substance, the abscess cavity having first been again demonstrated with the aspirating needle, and the needle used as a guide. The pus was found to be very deep-seated, about two and a half inches from the liver surface, and in quantity amounted to about two ounces. A large rubber drainage tube was inserted into the abscess cavity and the wound dressed aseptically in the usual manner. The patient experienced great relief as the result of the operation, and two days afterwards said he was quite free from pain. The temperature, however, still continued, and although the blood was repeatedly examined during the next few days, no parasites were discovered in the corpuscles, and as a consequence no quinine was given. The wound was dressed twice a day, and after three days' time little or no pus was discharged into the dressings, the wound remaining perfectly aseptic. The slight degree of jaundice from which the patient was suffering immediately before the operation still continued, but the stools showed bile colouration, proving thereby that there was no complete obstruction of the hepatic duct.

On the morning of October 24th the patient again complained of great pain in the liver; the jaundice, from which he was at the time only slightly suffering, greatly deepened, and by the morning of the next day his pulse-rate had fallen to 60, with the temperature 102° F., and his urine showed distinct bile colouring. I was of the opinion that the symptoms were caused by another abscess, and made preparations for attempting to discover and open it the next day if possible. On the following morning, however, the patient said he felt quite well, and all pain had disappeared, but on dressing the wound the dressings were found to be saturated with bright green bile. I did not explore the liver that day, but decided to await events. The symptoms of jaundice due to the presence of bile in the circulation rapidly began to abate, and on October 28th the patient's condition was as follows: The conjunctivæ had nearly recovered their normal colour, always a light yellow in the Negro; the pulse-rate was in accordance with the temperature; the stools were almost white, the urine was normal, and the wound was discharging bright green bile freely.

It was very evident that some obstruction to the passage of the bile to the intestine existed, but the cause was not so evident. On October 29th I again explored the liver very thoroughly with the aspirating needle, but no abscess was discovered. On one occasion the point of the needle was felt to enter a cavity, and a quantity of bright green bile was drawn off,

the cavity evidently being a dilated bile duct. I then concluded that the obstruction to the hepatic duct might be catarrhal in nature, and prescribed saline purgatives, together with the usual alkaline treatment for catarrhal jaundice, and at the same time plugged the abscess cavity in the liver tightly with sterile gauze, with the idea of preventing the escape of bile, and so bringing more pressure to bear on the occluded duct. To my relief, and also to my surprise, this treatment was successful, and on November 1st it was noticed that very little bile escaped into the dressings, and on November 3rd the stools again showed bile colouration. The temperature, which up to this time had been irregular, fell to normal, and the patient made a rapid recovery, being discharged from hospital on December 10th, on two months' sick leave to his village on the White Nile. This case appears to me to widely differ in its course from most cases of liver abscess, and the occurrence of a biliary fistula is, I believe, most unusual after an operation for the relief of this condition. It seems probable in this case that a large bile duct situated in the wall of the abscess cavity became dilated as a result of the occurrence of obstruction to the passage of the bile to the common duct, and not being supported on all sides by the liver substance, gave way, and the bile being discharged into the abscess cavity, made its way to the surface through the operation wound. A great quantity of bile escaped daily, and possibly all the secretion of the liver passed out of the body in this manner. It is possible that the bile coming from the left lobe through the left duct, on meeting with an obstruction to its onward flow to the duodenum, regurgitated backwards through the right bile duct, following the line of least resistance, until it escaped at the point of rupture of the bile duct. The clinical symptoms of the case also pointed to a complete absence of bile in the circulation after the formation of the biliary fistula, and the presence of an obstruction in the hepatic or the common bile duct was proved by the appearance of the fæces. In my treatment of the case I plugged the abscess cavity with sterile gauze, so as to prevent the escape of the bile as far as possible. I do not think this can really have had much effect; the cause of the obstruction was probably catarrhal in nature, and this was relieved either naturally or by the medicinal treatment prescribed. The site of the obstruction may have been either in the hepatic duct or in the common bile duct, and no symptoms presented themselves which could make a diagnosis as to its position possible. The case, which I have attempted to describe, appears to be of some interest, and none of my colleagues, the British medical officers attached to the Egyptian Army, have ever seen a similar case, and they are, like most British military surgeons, men of wide experience in tropical abscess of the liver.

Editorial.

REVIEW OF RESEARCH WORK DONE BY THE ROYAL ARMY MEDICAL CORPS IN 1904.

At the beginning of a new year it may be well to briefly review the work done during the past year, as recorded in the pages of the Journal.

No one has yet responded to our appeal to work out how the infection of Surra is carried. To assist in matters of this kind a pamphlet on biting flies, issued by the British Museum, has been sent round to each R.A.M.C. officer. There was also an excellent paper on the same subject (vol. iii., p. 117) by Major N. Manders, R.A.M.C., entitled, "On the Collection and Preservation of Phlebotomic Diptera."

In Dysentery little has been done. Brevet-Lieutenant-Colonel C. Birt, R.A.M.C., wrote (vol. ii., p. 147) an abstract of the recent literature on the subject. We look to him to advance our knowledge of this most important army disease. No one, up to the present, has laid down sufficiently rigorously the exact species of bacillus which is the causal agent of this disease, where and under what conditions it exists in Nature, how it gains access to the body, and under what conditions it sets up its pathogenic action. There is still much obscurity as to how many different diseases may be included in the term.

A case of Blackwater Fever was described by Captain J. H. Rivers (vol. ii., p. 156), but this disease still requires further elucidation. An editorial appeared (vol. ii., p. 352) on this form of fever, giving an account of recent work and suggesting lines of research.

In Vol. ii., p. 413, there is given a description of the new Royal Army Medical College and Laboratories. There has been some delay in breaking ground, but we are glad to learn that the difficulties have been surmounted, and it is believed the foundations will be begun about the beginning of this month.

Until we get into the new laboratories we cannot expect to make any very rapid progress, as it is impossible to get work done in the present cramped surroundings on the Embankment. But when the new College is built, and there is elbow-room and a hospital close by to supply material, the output of work in the investigation and prevention of diseases affecting soldiers should much increase.

Good work has been done on Malta Fever during the past year. Two editorials (vol. ii., pp. 485, 731) appeared in the Journal,

giving an account of our present knowledge of the disease. Since then a committee has been formed by the Royal Society at the request of the Colonial Office, Admiralty, and War Office, to take steps for the investigation of this fever. A commission has been sent out to Malta, on which is Major W. H. Horrocks, R.A.M.C.; Captain J. C. Kennedy, R.A.M.C., also joined in the work, and has given great assistance.

We congratulate Major Horrocks and Captain Kennedy on the very excellent work already done, and trust that the work will not stop until the etiology of this long and tedious disease has been thoroughly cleared up.

An account of the work done will be given after the Royal Society's Reports have appeared.

In regard to Malaria, only one short paper by an R.A.M.C. officer, Major J. V. Salvage, appeared. We are indebted to Lieutenant-Colonel G. M. Giles, I.M.S. (R.), for a paper on "The Anti-Malarial Operations in Mian Mir." The excellent summary by Major T. McCulloch, R.A.M.C., entitled "Malarial Fevers among British Troops" (vol. iii., p. 79), may also be referred to. We would be glad at any time to receive reports on the results of Anti-Malarial work.

Not much original work has appeared on our most important disease, Enteric Fever. Captains W. S. Harrison and L. W. Harrison, R.A.M.C., wrote a paper "On the Effect of Drying and of Exposure to the Sun of the Typhoid Bacillus under Indian Conditions," which showed "that typhoid bacilli will survive, potent for mischief, in Indian dust and under an Indian sun sufficiently long to be blown through and through barracks and camps when deposited on the ground in the form of typhoid-infected urine, or blown as infected dust from the dry earth used in the latrines."

Another suggestive paper, entitled, "The Spread of Enteric Fever by Urine," by Captain E. Blake Knox, R.A.M.C., was also published.

Lieutenant-Colonel H. L. Battersby, R.A.M.C., Major A. R. Aldridge, R.A.M.C., and Captain W. S. Harrison, R.A.M.C., also gave us useful papers.

Is it not time that this question of Enteric Fever in our garrisons and camps should be taken up from the dust point of view? From these papers it would appear that a dangerous condition of things exists in our sanitary arrangements. Would it not be well for a Commission to be formed to enquire and report on the matter?

Sleeping Sickness has been steadily worked at by Captain E. D. W. Greig, I.M.S., and Lieutenant A. C. H. Gray, R.A.M.C.,

during the past year, and an excellent report embodying the result of much painstaking work has just been received. Captain Greig is on his way home, and Lieutenant F. M. G. Tulloch, R.A.M.C., has been sent out to join Lieutenant Gray.

It is to be hoped that these two junior officers will take full advantage of this opportunity of advancing our knowledge of this important disease. There is still much to be done. The exact distribution of *G. palpalis* in Uganda; the exact distribution of the disease; the length of the incubation period; the percentage, if any, of recovery from the first stage of the disease; whether there is any possibility of two human trypanosome diseases occurring alongside each other in Uganda; treatment and prophylaxis; and many other problems.

The diagnosis and treatment of Venereal Diseases has been made the subject of an inquiry by a sub-committee of the Advisory Board for Army Medical Service. Major C. E. Pollock, R.A.M.C., was detailed to visit the important cliniques on the Continent, and may be congratulated on the good work he has done, the results of which have been embodied in various Reports. The final Report has not yet appeared, but may be expected shortly.

Our knowledge of Leishman bodies has been steadily growing during the last year, and an excellent summary, entitled "Notes upon the Further Investigation of the Parasites of Kala Azar and Delhi Boil," by Major W. B. Leishman, R.A.M.C., appeared. It has become usual to call this parasite the Leishman-Donovan body. Why this double name should have come into vogue is difficult to understand. As far as our reading permits us to form an opinion, it was Major Leishman, and Major Leishman alone, who discovered this protozoon. Donovan and others merely confirmed his discovery. One of the most startling observations on this parasite has been made by Captain Rogers, I.M.S., who found that by simply placing a small quantity of citrated splenic blood from a case of this disease in a test-tube, and keeping it at room temperature, flagellated bodies developed. This observation, for which the highest honour is due to Captain Rogers, has been confirmed by Captain J. C. B. Statham, R.A.M.C., at Netley.

A suggestive paper on this subject, entitled "Enlargement of the Spleen in Lower Bengal," by Lieutenant J. McKenzie, R.A.M.C., ought also to be noted.

Major F. Smith, D.S.O., has been working hard at West African problems during 1904, and we hope to publish his results soon. He returns to England this month, and Captain H. W. Grattan takes his place.

BLOOD-SUCKING INSECTS AND TROPICAL DISEASES.

The Director, British Museum (Natural History), Cromwell Road, London, S.W., has sent us, at our request, 1,000 copies of a pamphlet on Blood-sucking Flies, a copy of which has been sent to each R.A.M.C. officer. The pamphlet is accompanied by a statement by Professor Ray Lankester, F.R.S., as follows :—

"The importance of blood-sucking insects and other animals as possible disseminators of pathogenic organisms being now universally recognised, it is absolutely essential, firstly, that medical men and others engaged in improving the sanitation of tropical countries should have the means of determining correctly the names of blood-sucking species with which they may come into contact; and, secondly, that a well-preserved collection of modern specimens should be available in London for comparison.

"The British Museum has already dealt with the mosquitoes and tsetse-flies, and it is now proposed to publish on similar lines a further series of monographs on the other blood-sucking forms. The material at present at our disposal, however, is insufficient for this purpose, and it is therefore hoped that all medical men and naturalists residing in British Colonies, or in the Tropics in any part of the world, will make special endeavours to obtain specimens, and send them addressed to the Director, British Museum (Natural History), Cromwell Road, London, S.W., together with notes on the names, habits, and distribution of the insects. This appeal is made especially to the medical officers of the Foreign and Colonial Services, to the medical officers of the Navy, Army, and Indian Services, and to all official representatives of H.M. Government in foreign parts.

"The accompanying pamphlet, which has been prepared in order to assist those who may be willing to help the Museum in this way, is mainly devoted to the blood-sucking flies (Diptera), and contains a *résumé* of what is known of their appearance, habits, and life-history, with illustrations of typical forms, and full directions as to the collection and transmission of specimens to England.

"When a collection is despatched a separate letter of advice stating the fact should always be sent; the expense of sending collections to the Museum, by parcel post or otherwise, will be refunded. All collections forwarded to the Museum, and addressed as stated, will promptly be acknowledged; and so soon as efficient material has been obtained the preparation of the first monograph will be commenced."

Philosophy, Travel, &c.

THE ORIGIN OF LIFE.

II.

By Lieutenant-Colonel BRUCE SKINNER.
Royal Army Medical Corps.

The strata contained in the earth's crust, within which were laid down the fossilised life-forms already referred to, were largely the result of disintegration of pre-existing rock and the subsequent rearrangement of the disintegrated material in beds or layers. The presence of a pre-existing rock carries us back to an earlier stage in the history of the evolution of the earth.

The present condition of the stars gives us a series of pictures of the phases through which our world must have passed. Certain stars are in a gaseous condition, maintained by a temperature which is so high as to defy measurement by any means at our disposal. Others present various stages of cooling, till we arrive at our sun, whose temperature is something above 8,000° C. There are stars also, whose temperature has been calculated at 3,500° C.

These bodies present us not only with a view of the temperature conditions undergone by the earth during the cooling process, but they also show the same chemical elements in various stages of evolution, becoming more complex in their combinations as they become cooler.

The process of cooling may be pictured to the mind by the idealisation in the first instance of a glowing gaseous body, succeeded by a globe of incandescent material surrounded by superheated gases, and this again by a seething bubbling mass surrounded by vapour. The next picture would show the mass with a surface less mobile, while the water of the surrounding vapour was condensing and falling as rain, the atmosphere becoming gradually clearer. Later, glimpses through the surrounding fog would present to our vision a sheet of hot water through which perhaps, rock-masses were protruded. As the cooling outer film of the earth's mass contracted, its volume would be lessened and cracks would occur through which the deeper-seated, and consequently more heated material would escape, and distortions would be caused in some parts by the outward pressure of the material escaping from

within pushing up the crust on one or both sides of fissures; in other parts by the downward sinking of the outer film in consequence of the diminution of pressure in the subjacent matter due to escape of the inner material; and in still other cases, by the lateral thrust and creep of the contracting film. The sum of these processes would be the formation of land-masses, and the accumulation of the water in the depressions.

Thus, from gaseous material were formed the rocks which preceded the stratified deposits. The next step was the disintegration of such rocks as were exposed to alternations of temperature, to wind, rain and flowing water, and finally, to the action of life-forms, both vegetable and animal.

Seeing as we do, the earth of to-day teeming with life-forms which contain within themselves evidences of community of descent from other life-forms, the contrast with the epochs sketched above is somewhat startling. We realise that the first-formed crust of the earth, consisting of cooled molten rock, must have passed through conditions of temperature in which the presence of life as we understand it, was impossible—the earth must have been absolutely sterile. In the words of Sir Charles Lyell, "we can look back to the period when the heat was so intense as to be incompatible with the existence of any organic beings such as are known to us in the living or fossil world" ("Principles of Geology," 1868, vol. ii., p. 213).

In prosecuting the study of the rocks geologists have discovered, and are still adding to their discoveries, the remains of life-forms within the strata of the earth's crust; these life-forms, considered broadly, indicate a scale of development decreasing in complexity down to a period when the evidences of the existence of living forms are scanty, and the forms themselves are of a low type; but the lowest fossil types hitherto discovered are not as low in the scale as some types still existing. The reason for such a condition is obvious; the lowest life-forms having neither external nor internal skeletons are not adapted for preservation within the rocks in a recognisable form. Yet, among such forms as have been preserved as fossils, there is generally manifest an order of increasing complexity of development and differentiation from below upwards. This fact has given rise to the contention that the fauna and flora of to-day did not appear as finished types, but originally as lowly forms adapting themselves to the conditions to which they were subjected; and that these forms increased both in numbers and complexity of development, or disappeared, in accordance with the

success or failure of their powers of adaptation to changes in their surroundings. Consequently, we may look backward to a time when the lowest forms, that is, non-differentiated masses of protoplasmic material, stood as primeval and sole representatives of the vast collection of life-forms of the present.

But as we have seen that the molten earth must have been at a temperature which would destroy all modern life, we have to conclude that the world must, when molten, have been biologically sterile. We are then in face of the problem as to whence life-forms arose. And in this connection it may not be amiss, seeing that we have as yet no data by which to satisfy our curiosity, to read the following passage from Huxley :—

" Looking back through the prodigious vista of the past, I find no record of the commencement of life, and therefore I am devoid of any means of forming a definite conclusion as to the conditions of its appearance. Belief, in the scientific sense of the word, is a serious matter, and needs strong foundations. To say, therefore, in the admitted absence of evidence, that I have any belief as to the mode in which the existing forms of life have originated, would be using words in a wrong sense. But expectation is permissible where belief is not; and if it were given me to look beyond the abyss of geologically recorded time to the still more remote period when the earth was passing through physical and chemical conditions, which it can no more see again than a man may recall his infancy, I should expect to be a witness of the evolution of living protoplasm from not-living matter. I should expect to see it appear under forms of great simplicity, endowed like living fungi with the power of determining the formation of new protoplasm from such matters as ammonium carbonates, oxalates and tartrates, alkaline and earthy phosphates, and water, without the aid of light. That is the expectation to which analogical reasoning leads me; but I beg you once more to recollect that I have no right to call my opinion anything but an act of philosophical faith" ("Critiques and Addresses," p. 238).

Here, however, Huxley's philosophical faith postulates an advanced complexity in the chemical compounds which were to provide the pabulum from which new protoplasm was to be formed by pre-existent protoplasm. As the presence of this protoplasm, and even of the complex oxalates and tartrates would indicate that living matter already existed, we must allow our philosophical faith to antedate the oxalates and tartrates by a period when the carbon, hydrogen and oxygen composing them existed as simpler combina-

tions in the so-called not-living matter—the water, the atmosphere, and the cooled rocks ; a period when these three elements existed, so far as this earth is concerned, only in rock material and in water, in the atmosphere surrounding the globe, and in the gases contained, perhaps, within the rock.

An alternative is to believe with Lord Kelvin[1] "that there are at least, and have been from time immemorial, many worlds of life besides our own," and, consequently, that we may with "many regard it as probable in the highest degree that there are countless seed-bearing meteoric stones moving about through space," which might have brought life on to this earth. If we accept it as probable that living forms arrived on this earth from other worlds of life, we must assume that these living forms found on their arrival here such a practical similarity between their old and new surroundings as to permit of their continued existence. We must also recognise that their old surroundings had evolved in a manner similar to that by which their new surroundings had taken shape. We are thus faced with the necessity of explaining how the living forms originated in their old surroundings, which we cannot handle, under conditions similar to those obtaining in their new surroundings. Unless we are prepared to assume that living forms are practically eternal, we cannot be content to project their origin to a succession of distant worlds, from which they may have been fortuitously ejected through space to find new spheres for their life-action. By accepting such an alternative we are only placing further out of reach the investigation of a process which might equally well have occurred independently on this earth, if it occurred independently on other worlds. For if living things have not been eternal, they must have originated somewhere *de novo ;* and if they originated in other worlds which had undergone phases similar to those which obtained in this, they may equally well have originated on earth.

All biologists are aware that the media used for cultures, when properly sterilised and adequately protected from the access of infection, are incapable of producing life. That fact is conclusively proven, not only by laboratory experiments, but by the practical application of that principle to modern surgical processes. The proof is so obviously correct that it is past conception that one should think of imagining that newly formed living matter could

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[1] "Popular Lectures and Addresses," Presidential Address to the British Association, 1871.

arise out of what is dead; but even if living matter could arise from not-living matter, it could only do so, as shown below, under certain favourable circumstances, and consequently our laboratory processes, if properly carried out, as well as our surgical operations, would remain on a basis as satisfactory as that which is universally known to obtain at present when the possibility of infection from outside the test-tube or the body is adequately guarded against.

In the laboratory the heat required for sterilisation has destroyed vitality in the organic matter to which it was applied. Any living protoplasm which may have been present has been converted into something which is not living. Further, the medium, even if its chemical composition had been such as had been sufficient to provide the material for the formation of life, has been so damaged that its condition may be looked upon as inert; for the application of sufficient heat has dissociated the force and energy necessary to the manifestation of life. The protoplasm, if present, and the medium have been placed in a position analogous to that of water which has been converted from a liquid into steam. A new external agency is required to restore it to the condition it held before the application of heat.

While recognising the truth of this biological fact, it must equally be recognised that life may have originated on this earth. Bearing in mind the temperature through which the earth passed in the process of its evolution, living forms may have originated from not-living matter. We have excluded the possibility of their first appearance here by importation.

This origin is not demonstrable in the chemical laboratory, for with our knowledge of the accidents which are liable to happen to the best-conducted experiments, we should never feel sure that the appearance of living forms in a test-tube or retort charged originally with not-living matter was not due to accidental infection. For if we are to obtain living forms from not-living matter by experiment, it must be at a temperature which will not destroy life. That is to say, the C, H, N and O necessary for its formation must be obtained in a "sterile" condition, and must be combined by some process which, while preventing access of external infection, will ensure the non-destruction of the viability of the components and the compound; in other words, the ionisation of the molecular constituents of the mass to be operated upon must not be destroyed. This has not yet been achieved by the chemist, even though he may have produced protoplasm in his retort. His protoplasm has been not-living because the process of its formation has necessitated the

dissociation of energy and force through the assistance of the means used in manufacture. That being so, we must realise that life must be a manifestation or property which depends upon the action and interaction of the force and energy present in the components of the mass which we call living protoplasm.

Huxley considered the physical conditions of the earth of to-day unequal to compass the evolution of living from not-living matter. Dr. F. J. Allen[1] says, however, that "first attempts at life may be occurring continually around us." It certainly does not seem to be unreasonable to suppose that wherever the constituents of the earth's crust are in an active condition of chemical change, where the C, H, N and O may be looked upon as being in a "nascent" state, at such places chemical re-combinations of various and varying complexities and instability may be taking place; whether such may be sufficiently complex and unstable to produce living protoplasm to-day out of C, H, N and O, it is impossible at present to state as an accomplished fact. The earth is at this epoch so crowded with organisms that if living protoplasm were now being formed it might possibly, Dr. Allen suggests, "be seized and assimilated." With regard to the latter point, the analogous position held by seeds and spores indicates the probability that the life of newly forming protoplasm would not be as abruptly terminated as Dr. Allen supposes. For seeds and spores, as we know, are universally distributed; not only in desert places do they escape extermination by assimilation by other life-forms whose continued existence depends on such things for food. Meanwhile, we may enquire from other sources as to whether there is evidence to bear upon the possibility of such origination of life.

Should it be the case that life is now originating on this earth, it is taking place under limitations of temperature, air, moisture, and chemical composition of the soil, under the stimulus of a suitable agency. Wherever these may be favourable, biogenesis will occur. The limitations may perhaps be stated as a temperature of from 16° C. to 20° C., the presence of a sufficiency of H_2O and of air, and a soil or medium containing C, H, N and O within chemical compounds undergoing changes involving rearrangement of their constituents. Whether the agency effecting the change be a change of temperature, either from a low to a higher, or from a high to one lower, is not known; but the probability is that the

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[1] *Nature*, November 17th, 1904, p. 54.

electric condition of the mass will be more active if the temperature is rising from one considerably lower than 16° C. It is conceivable that the necessary re-combinations may be effected by an electrification of the mass from outside, by altering the stability of its ions.

Seeing the widely separated areas which might present such conditions, it may be presumed (excluding the polar regions in their present glaciated state as too cold for the manifestation of such life) that it should be taking place at many localities scattered round the globe. In such case we should expect to find wide-spread evidence of its presence by the presence in each area of forms becoming more highly developed than simple protoplasm, forms progressing in their evolution up to the highest possible types. For if it be an innate property of protoplasm to evolve higher forms, it would surely carry out this process wherever it first automatically appeared. Although recognising that evolution can only progress where conditions are favourable, we cannot limit that progress to one country or even to one continent, for by so doing we should have at the same time to limit the progressive capabilities of our protoplasm.

We have two possibilities before us. The first is Professor Huxley's position that protoplasm may once have originated *de novo* at a period limited to a remote past. The second is that protoplasm may still be forming *de novo* under favourable conditions from not-living matter.

In the case of the first possibility we should expect to find a wide-spread origination of life, with its subsequent development into higher forms in localities scattered over the earth.

In the case of the second we should require ocular demonstration of its formation. Further, we should expect evidence of the existence of transitional life-forms linking together the types in an unbroken succession, so far as they had progressed in their evolution.

How far either of these can be demonstrated as obtaining in the past or the present, must be investigated by a study of the geological history of our earth, and by an examination of the distribution of life-forms.

(*To be continued.*)

THE HOMBURG TREATMENT FOR ANGLO-INDIANS.

By Colonel B. M. BLENNERHASSETT.
Royal Army Medical Corps.

Having personally undergone a course of these waters, and the "after cure," I trust a few remarks on the subject may prove not only of interest, but of benefit to those who, like myself, have served for a considerable time in the Tropics.

It is an undoubted fact that a long residence in India produces a strain on the internal organs, more especially the liver and spleen. Malarial fever and Malta fever are also far more common than is generally known.

Now I maintain that a regular and prolonged course of these waters (the Elizabeth and Ludwig wells), with a careful regulation of diet, and avoidance of alcohol and tobacco, will produce a decided beneficial effect in the worst cases, and a perfect cure in thousands of the more simple class.

It is a profound matter of congratulation, both for ourselves and our patients, that we now apply practical common-sense in dealing with these diseases, in the way of physical and mental rest, fresh air, free ventilation, equable climate, pleasant surroundings, regulation of diet, cleanliness and general comfort; and, in this connection, we find in Homburg all that is desired, *plus* the physiological effects of these superb mineral springs, containing carbonic acid and chloride of sodium.

In these cases the water of the Elizabeth well, taken in small doses (for absorption), has a wonderful and permanent effect, the cure being speedy and sure.

Nearly all these chronic tropical diseases lead to anæmia, often of a most pernicious kind; here, again, I can strongly recommend these waters. These wells, rich in carbonic acid and salts, will have a resolvent effect on the enlarged and inactive glands, which are the actual cause of the anæmia. The moderate temperature, the cold night, the dry atmosphere, will do the rest.

The town of Homburg is situated at the foot of the Tannus Mountains, 602 feet above sea-level, and nearly 300 feet above Frankfurt-on-the-Main, the distance from which is about ten miles; twenty-five minutes by rail. The population of Homburg is about 10,000. A chain of mountains forms a semi-circle round the town, which affords shelter on the west and north-west, whilst a huge spur, lying due east and covered by thick forest, protects it

from easterly winds. The drainage of Homburg is good—connected pipes are laid down through the streets, and the house and rain-water are entirely separated, and all impurities carried out of the town immediately; whilst patent self-closing dust-bins are used for house-to-house collection of domestic refuse. The drinking water comes from the "Tannus Range," a healthy and pure water. The public health is excellent, 19 per 1,000. The nights are always cool and pleasant. The prevailing winds are south and south-west. The soil is clay, well covered with sand on roads and paths.

The Springs.

The springs are numerous, but I will only describe those which I have had practical experience of :—

(1) *The Ludwigs Brunnen*, originally discovered by chance in 1809. The real well was tapped in 1843, at a depth of 120 feet; but it was further deepened in 1845 to 140 feet. This water is rich in salts and free carbonic acid, especially chloride of sodium, diuretic, and only slightly aperient.

(2) *The Elizabeth Brunnen*, described by Liebig as the richest spring of carbonic acid in Europe. This is the most important of all the springs, and richer in medicinal qualities. It acts as an aperient and a diuretic. Should be taken tepid before breakfast; sipped slowly, so as to be absorbed. By drinking this water the kidneys and uretic canals are washed out, and all deposits removed, and a gentle but certain action of the bowels daily obtained. In 1,000 parts of the Elizabeth spring we find :—

Chloride of sodium	9·86	Chloride of ammonia ..	0·02
,, potash	0·34	,, lime	0·68
,, lithia	0·02	,, magnesia ..	0·72

This is a truly wonderful water, and a steady course of three weeks or one month will remove all deleterious matter from the internal organs, reinvigorate the clogged liver and free the system in a manner that no medicinal treatment will effect. The quantity of water a patient must drink, of course, will vary as regards the case, but one or two glasses, from 10 to 20 ozs., either tepid or warm, will in most cases be sufficient. The water should be sipped to be digested, and a slow walk of one to two miles taken before breakfast. It is a mistake to take too much, as the most important part of the treatment is the proper digestion of the ingredients of the water. It is quite impossible to define the period that the waters should be taken, every case differs; as for myself, I took two glasses of the Elizabeth every morning for three weeks (tepid), and

for the fourth week I had an additional glass from the Ludwig well. A strict dietary should be observed, principally milk, and on no account should strong wines or smoking be indulged in. I cannot too strongly recommend the above treatment to those who are debilitated by anæmia, sluggish liver and dyspepsia, the result of long residence in India. Here the old Indian is brought under a genial climate, pleasant surroundings, and a moderate temperature, with cool, agreeable nights, and these waters will soon produce their resolvent effects on his enlarged and inactive glands, and eliminate from his system the deleterious substances he has for years been accumulating. The high repute the Homburg mineral springs have gained is well justified. There is hardly another place in Europe which combines such advantages and curative resources.

Regarding the baths I cannot say much, as I have not tried them, nor, indeed, do I recommend them for those who are in a feeble state of health worn out by long tropical service, such cases will find the Elizabeth well quite sufficient, combined with a lowering diet and avoidance of stimulants. The chief baths are the Soolsprudel and the Landgrafen Brunnen. The former was opened in 1898 to the depth of 260 metres, the latter in 1899 to a depth of 150 metres. Both contain an unusually high amount of carbonic acid, and give wonderful results in gouty cases. The bathing water enters the bath in its natural state and is there warmed by steam circulating between the double bottoms of the bath (the Schwarz method), any deterioration is thus avoided, and the chemical constituents are undisturbed.

Sport.

Sport is encouraged at Homburg—beautiful lawn tennis grounds (twenty-six courts), an excellent golf club, and a picturesque croquet ground, are all available. The walks are numerous and the drives good.

The hotels are most comfortable and not expensive, and I can recommend the Victoria, as being in a central position; Ritter's, as close to the park and golf grounds; the Albion Hans, as economical and comfortable.

The mean temperature for the summer months is as follows:—

May	10·10° R. ..	56·2° F.
June	15·04° ,, ..	66·1° ,,
July	14·50° ,, ..	64·6° ,,
August	15·05° ,, ..	66·1° ,,
September	10·54° ,, ..	55·6° ,,

The mean height of barometer in summer 756 mm.

It must not be supposed that a course of Homburg waters has left the system braced and strong; on the contrary, it leaves the patient relaxed and requiring a change of climate to restore the vital energies, hence it is always advisable to undergo what is called the "after treatment," and there is no place, in my opinion, to compare with Mürren in the Bernese Oberland of Switzerland, situated in the most beautiful spot of Swiss Alpine scenery; here you have those magnificent chains of the Alps commanded by the Jungfrau, Münch and Eiger, giving an incomparable panorama, when coupled with the glorious range of the Gletscherhorn, Mittaghorn, Grosshorn and Gespaltenhorn.

The village of Mürren occupies a broad sheltered terrace 5,300 feet above sea-level, and face to face with the snow-topped peaks of the Jungfrau range. Here we can see the chamois grazing at a height of 10,000 feet, while at a less elevation the hill-sides and woodlands are one mass of flowers of infinite beauty and variety. The white crocus, violet bells, gentians, anemones, auriculas and primulas, besides a wealth of Alpine flowers.

Mürren has a southern exposure and equable temperature, and is most suited to cases of nervous debility, anæmia, malarial cachexia, dyspepsia, and insomnia. It is easily accessible from Interlaken and Grindelwald by rail to Lauterbrunnen, thence by funicular to Grutschalf, and from thence by electric rail to Mürren village. It is protected from north-west and east gales by lovely encircling hills and lies fully exposed to the southern suns. The opposite snows and glaciers, although in close proximity, are separated from Mürren by a deep chasm-like valley 1,600 feet deep. These snows and glaciers reflect the solar rays upon the Mürren plateau, thus pleasantly adding to the warmth in spring and autumn. Favoured in this way, Mürren can show a continuous maximum temperature excelling that of other Alpine resorts of equal elevation. There is a freshness in the air, a stillness, with a dazzling brightness on the surrounding glaciers, with a not infrequent sound like thunder from the huge avalanches which can be daily seen, which would kindle the vital spark of the oldest resident in Calcutta or Madras. But the energetic can amuse themselves by climbing the Schulthorn, 10,000 feet, or the Münch, 14,000 feet, and those of a more feeble frame can enjoy the magnificent scenery, the charming walks, the lovely pine-woods, and the green and fertile plateau carpeted with flowers. In a word, Mürren is a gem sanatorium, an ideal spot in a glorious land; the pure air, the radiant light, act at once as an antiseptic, a germicide and a bactericide.

I will now conclude with a few remarks on the mountain railways I have lately had the pleasure of travelling by. The Lauterbrunnen to Grutschalf, is a funicular and cogwheel line, with a combined length of 1,380 metres, difference of altitude 670 metres, average rising gradient 35 per cent. The Grutschalf to Mürren rail (electric), difference of altitude 151 metres, rising gradient 5 per cent. The Lauterbrunnen station is 1,816 metres above sea-level. The Grutschalf station is 1,490 metres above sea-level. Mürren station is 1,641, while Mürren village is 5,400 feet above sea-level, and a cog-funicular rail is already nearly half-way up the grand and precipitous face of the snow-topped "Jungfrau," 14,000 feet, and in three years more it is to reach the top. These rails are not the gradual and easy ascent of the silky, grassy hills from Kalka to Simla; here "it's right overboard" on the slightest accident, with a drop that would considerably alter the atomic theory of bodies combining, should you try it. Up goes the funicular by a sheer precipice of straight rock, the kind of thing you read about but never see, except in Switzerland; if you put your head out of the carriage window, while the ascent is 55 per cent., and look down, well, it makes your heart dance, and you can feel the peristaltic action of your "ductus communis choledicus" exuding bile like a Byculla cook does Madras curry on a guest night. The great "Jungfrau" is just facing Mürren, and its bare rough basement commences close to my window (Hotel des Alpes), but separated by a huge chasm 1,500 feet deep, so you must not think that you can light a match on it, by stretching from your bedroom window. It is wonderful viewing the wild chamois grazing on its high and rugged cliffs, and often protecting their young from the ferocious attacks of the blue-crested eagle. I would say that the climate of Mürren is most bracing and tonic, that the place contains a spacious tract of land, in part flat, in part gently sloping, and at a short distance assuming a mountainous character. Every visitor can obtain just the kind of exercise, gentle or otherwise, which suits his taste or the state of his health. There are a great variety of the most lovely walks, and numerous excursions can be made to places of interest. The highest point in the plateau of Mürren is about 1,000 feet above the Hotel des Alpes. The last words are to the Indian invalid, to retired officers, commissioners, and worn-out Calcutta jute merchants, "try Mürren."

WITH THE TIBET MISSION FORCE.

By Major A. R. ALDRIDGE.
Royal Army Medical Corps.

The mission to Lhasa will soon be a thing of the past, but though as a military expedition it may be remembered only as one of our many small expeditions, yet the altered political relations with the country make the experiences gained of the climate and its effects on health of some interest. For a year the force in Tibet has been living at altitudes of 10,000 to 15,000 feet, and the effects of this have been noticeable in more ways than one. At these altitudes the boiling point of water is approximately 90° to 85° C., at which temperatures meat requires considerably more prolonged boiling than we are used to to render it fit to eat; while in the case of cereals and pulses on which native troops and followers largely live, this is scarcely sufficient to soften the envelopes of the starch grains, and the food is, therefore, much less easily digested. This has been particularly noticeable in the case of dhall and peas. Of course, the difficulty can be got over by baking, but this is not always easy under field-service conditions. Cooking pots with screw-down lids and safety-valves blowing off at a pressure of 14 lbs. would also be effectual, but would be heavy and scarcely suitable for the use of troops and followers.

At altitudes of 14,000 feet and upwards a considerable number of men have suffered from mountain-sickness, the most usual symptom being headache, in some cases with slight fever, general lassitude, loss of appetite and nausea. For the most part the symptoms passed off after a night's rest, but in some cases lasted two or three days, and occasionally only commenced on the second day at high altitude. It seems probable that a fatiguing march played a part in producing the symptoms. The experiments of Whymper in the Andes seem to show that the symptoms are due to the reduced atmospheric pressure rather than to diminished oxygen.

At 14,000 feet and above breathlessness is experienced by all, on the least exertion; this naturally makes the marching pace slow, and running or climbing very laborious. There is a corresponding increase in the heart-beats, and the increased work thrown on the heart has inevitably told on the weak or damaged ones. No less than nineteen men died from heart affections, and eighteen were invalided from the same cause, in a force of about 5,500 troops and 12,500 followers. Besides these, a considerable number of men, weakened by other diseases, died suddenly from syncope; several

while on sick convoy. In the cases in which no valvular disease existed the symptoms consisted of tachycardia, irregular action and bruits, with evidence of dilatation. These for the most part improved rapidly with rest at lower altitudes.

Chest measurements were made of men of the 19th Punjabies and 40th Pathans on their joining the force, and again after four months' residence at altitudes of 10,000 to 15,000 feet. The following table shows the results.

<table>
<tr><th rowspan="2">Total Number measured</th><th colspan="3">Number per cent. showing increase</th><th colspan="2">Average net increase per man</th></tr>
<tr><th>Maximum and minimum</th><th>Maximum only</th><th>Minimum only</th><th>Maximum</th><th>Minimum</th></tr>
<tr><td rowspan="3">638</td><td>35·3</td><td>9·4</td><td>10·5</td><td rowspan="3">0·14</td><td rowspan="3">0·16</td></tr>
<tr><td colspan="3">Number per cent. showing decrease</td></tr>
<tr><td>24·8</td><td>10·3</td><td>7·3</td></tr>
</table>

Captain W. B. Turnbull, I.M.S., has carried out some observations on the effects of altitudes on the composition of the blood, of which the following is a brief summary.

	Red blood corpuscles.	Leucocytes	Ratio
W. B. T. at Rungpo (1,800 ft.), average of 12 observations	5,184,000	9,584	$\frac{1}{540}$
W. B. T. at Chungu (12,500 ft.), average of 14 observations	5,652,000	8,136	$\frac{1}{695}$
Residents in the country (Tibetans, Sharpas and Sikkimese), average	6,275,000	10,820	$\frac{1}{520}$
British officers who had lived at 12,000 ft. and over for several months	6,787,250	9,911	$\frac{1}{684}$
Natives who had lived at 12,000 ft. and over for several months	6,668,000	10,948	$\frac{1}{609}$
New arrivals at Chungu (12,500 ft.), chiefly British officers passing through	5,723,600	9,634	$\frac{1}{594}$

The hæmoglobin percentage was found to rise and fall with the rise and fall of corpuscles. Differential leucocyte counts showed them always to remain in their normal relative proportions to each other. The isotonic point was not altered from normal. These results agree in the main with those of previous observers.

Judging from the rapid increase of the number of red blood corpuscles and the absence of normoblasts on arriving at the higher altitudes, and of any signs of blood destruction, such as high-coloured urine, jaundice, &c., on descending to lower altitudes, Captain Turnbull thinks the increase in the corpuscles is relative, and due to a

decrease in the proportion of plasma, and not a compensatory increase to allow of the carrying of more oxygen, as has been supposed by some writers.

The winter climate in Tibet is severe, and the effects of the cold are made more intense by a strong south wind which blows daily, occasionally accompanied by blizzards. The lowest temperature experienced was on the Taugla (15,300 feet), on January 7th, 28° of frost. At Phari (14,300 feet) and Tuna (15,000 feet) about 20° of frost were experienced almost nightly from the middle of October to the middle of March. Five deaths occurred from frost-bite, and forty-five men were invalided during the expedition. Over 200 cases of snow-blindness occurred in General Macdonald's force of about 2,500 troops and followers on the return march, as the results of two days' marching after a heavy snow-storm; and about the same number in another smaller column. The following records of temperatures have been made during the expedition:—

Chumbi (9,700 feet).

Mean daily temperature at 9 a.m.

July	August	September	October 1st to 15th
59·1	58·7	55·8	49·1

The minimum temperatures recorded in September and October, up to 15th, were 38·5° and 36° respectively.

Gyantse (13,000 feet.).

	April 21st to 30th	May	June	July	August	September 1st to 18th
Mean daily maximum	74	75·9	76·6	73·1	68·9	64·3
Highest recorded ..	82	89	89	89	78	70
Mean daily minimum	32	33·4	43·7	46·2	42	40·7
Lowest recorded ..	25	25	37	41	38	30

Tibet has, up to the present, been thought to be almost rainless; this is, however, far from being the case. During the period while the force was on the march to and in Lhasa, heavy rain fell almost daily, and the soil at Lhasa was practically water-logged. Sarat Chandra Das, in the account of his travels, describes the rain at Shigatse in August as "continuous." The following records were made of rainfall:—

	Jan.	Feb.	Mar.	April	May	June	July	August	Sept.	October
Chumbi ..	*Nil.*	4·58		7·69	5·55	6·07	4·68	4·10	5·69	2·89 (to 20th)
Gyantse ..	—	—	—	—	—	—	2·36	2·4 (to 10th)	—	

Very little enteric fever occurred. This was no doubt largely due to the small amount of susceptible material in the shape of British troops; for it must be admitted that the sanitary conditions of some of the standing camps were by no means unfavourable to its propagation. Two cases of the disease in Tibetans came to my notice. In one, under the care of Lieutenant Abbott, I.M.S., which was fatal in the second week, the lesions in the intestine were typical of the disease; and in the other the disease ran a typical course, with hæmorrhage from the bowel, and the blood serum agglutinated a dead culture of *B. typhosus* in a dilution of 1 in 40 in thirty minutes. From enquiries which I made it seems probable that the disease is not uncommon among Tibetans, and was not merely imported. A very considerable number of cases of continned fever of severe type and somewhat high mortality occurred at various posts from Phari to Gyantse, that is, at altitudes of 13,000 to 15,000 feet, in native troops and followers. Though returned as "remittent fever," they had not the characteristics of malarial fever, and in the few in which I had an opportunity of examining the blood malarial parasites were not found. As was to be expected, malarial fevers were common in the Teesta Valley and in Sikkim.

Of 300 cases in which the blood was examined by Captain Turnbull, I.M.S., malarial parasites were found in 57; benign tertian, 28; quartan, 3; malignant tertian, 26. Most of these cases occurred at or near Chungu (12,500 feet), in coolies who had come from various parts of India, and no mosquitoes were found there; the remainder at Rungpo (1,800 feet), where only *A. listoni* and *Stegomyia fasciata* were found. It is, therefore, probable that the infection was acquired either in India or while the men were coming through the Teesta Valley. At Chumbi (9,700 feet), I found specimens of *A. gigas* (Giles), and *Culex fatigans* (?), but no evidence was obtained that fresh malarial infections occurred in Tibet proper.

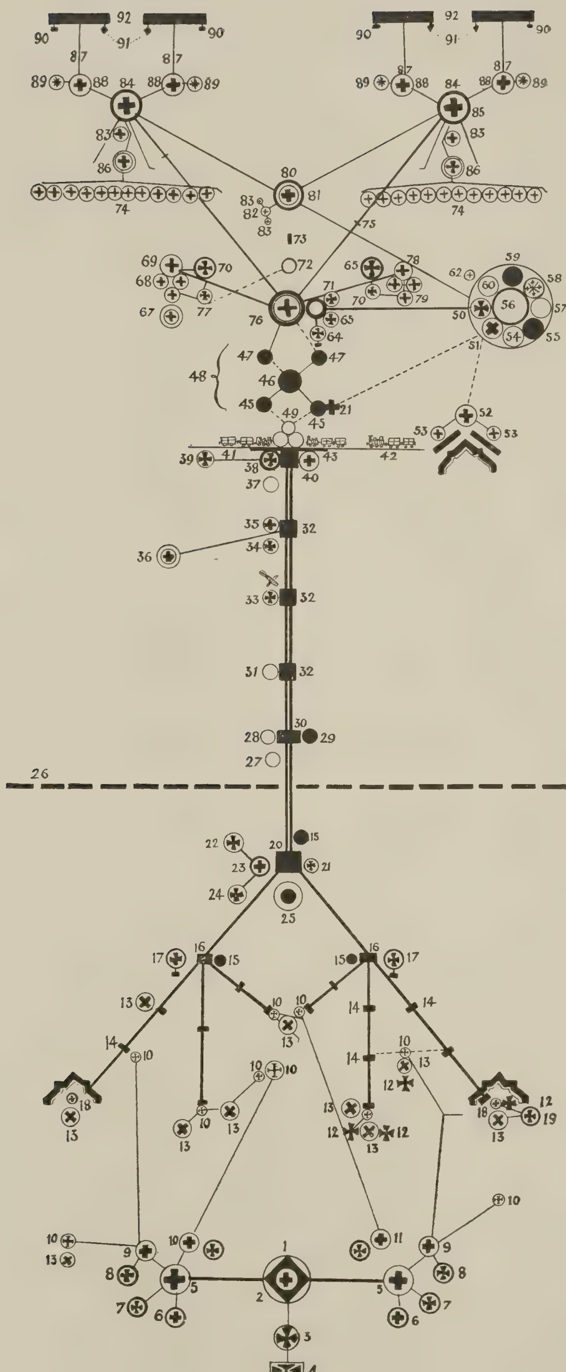
Dysentery and diarrhœa, on all parts of the line, and pneumonia at the higher altitudes, have accounted for a large proportion of the sickness and nearly half the deaths; they have existed at all times

of the year, but can scarcely be considered to have occurred in epidemic form at any place.

CHART TO SHOW MONTHLY ADMISSION PER 100 FOR MALARIA, TEESTA VALLEY FOLLOWERS.

Sikkim and Tibet seem to be somewhat liberally supplied with poisonous plants. Aconite is very plentiful in parts, both *Aconitum napellus* (L.) and *Aconitum paniculatum* (Lamarek) being repre-

sented. The natives, in parts where it is found, are in the habit of muzzling their animals. A considerable number of mules have died from aconite poisoning during the expedition. At Rungpo fifty-two coolies suffered from symptoms of poisoning from eating the seeds of the *Jatropha curcas.* The symptoms were those of severe gastro-intestinal irritation, with hæmorrhagic stools in some cases, and collapse. None of these cases were fatal. A fatal case of poisoning occurred in a mule driver from eating some berries; but as he had eaten several different kinds, the one or ones causing the fatal symptoms could not be identified.



THE GERMAN FIELD MEDICAL ORGANISATION IN WAR.

Translation.

THE GERMAN FIELD MEDICAL ORGANISATION IN WAR.

1 War Minister.
2 Deputy Chief of Medical Services.
3 Deputy Military Inspector of Voluntary Sick Attendance.
4 Central Information Bureau.
5 Deputy Principal Medical Officer of Army Corps.
6 Consulting Surgeon.
7 Territorial and Corps District Delegate.
8 Reserve Hospital Delegate.
9 Director of Reserve Hospital.
10 Reserve Hospital.
11 Representative of General Command.
12 Private Nursing Station.
13 Association Hospital.
14 Railway Commandant.
15 Lines Commandant.
16 Starting point of Lines of Communication.
17 Lines of Communication Delegate.
18 Fortress Hospital.
19 Fortress Delegate.
20 Collecting Station.
21 Surgeon.
22 Transport Detachment.
23 Sub-Delegate.
24 Depôt of Detachment.
25 Goods Depôt.
26 Boundary of Seat of War.
27 Collecting Station, Slightly Wounded.
28 Frontier Station, Sick Transport Commission.
29 Frontier Section, Transport Division.
30 Handing-over Station.
31 Refreshment Station.
32 Railway Commandant, Lines of Communication.
33 Nursing Station.
34 Station for Night's Rest.
35 Hospital, Lines of Communication.
36 Infectious Hospital.
37 Collecting Station, Slightly Wounded.
38 Lines of Communication Delegate.
39 Volunteer Depôt Detachment.
40 Surgeon, Lines of Communication.
41 Hospital Train.
42 Sick Train.
43 Auxiliary Hospital Train.
45 Staff Office (Traffic Management Department).
46 Railway Management.
47 Commanding Officer, Lines of Communication.
48 Headquarter, Lines of Communication.
49 Transport Division.
50 Imperial Commissioner and Military Inspector Voluntary Sick Attendance.
51 Chief of Medical Service in the Field.
52 Principal Medical Officer of Siege Corps.
53 Siege Hospital.
54 Chief of Railway System.
55 Chief of System of Lines of Communication.
56 General Staff, Headquarters.
57 Chief Field Post Master.
58 Chief of Military Telegraphs.
59 Field Commissariat.
60 General Staff Surgeon.
61 Senior Staff Surgeon.
62 Surgeon or Assistant Surgeon.
63 General Inspector Railways of Lines of Communication.
64 Volunteer Escort Detachment Depôt.
65 Volunteer Escort Detachment.
66 Representative of Army.
67 Stationary Field Officer.
68 *Personnel* of Field Hospital.
69 Director of Field Hospital.
70 Representative of Corps.
71 Transport of Volunteer Detachment.
72 Inspector of Lines of Communication.
73 Hospital Reserve Depôt.
74 Field Hospital.
75 Lines of Communication, Land.
76 Principal Medical Officer, Lines of Communication.
77 Volunteer Hospital Detachment.
78 Director of Field Hospital.
79 *Personnel* of Field Hospital.
80 Chief Army Command.
81 Principal Medical Officer of Army.
82 Staff Surgeon.
83 Senior, or Assistant, Surgeon.
84 Army Corps Command.
85 Principal Medical Officer Army Corps.
86 Consulting Surgeon.
87 Divisional Command.
88 Surgeon of Division.
89 One or two Companies Medical Corps.
90 Ward for Sick.
91 Local Hospital.

WATER TRANSPORT.

92 Regimental Surgeons.
93 Hospital Ship, Wounded.
94 Auxiliary Hospital Ship, Wounded.
95 Hospital Ship, Sick.
96 Hospital Sick Train (six ships), Wounded.
97 Auxiliary Ship Train.
98 Hospital Ship Train, Sick.

ADVISORY BOARD FOR ARMY MEDICAL SERVICES.

Report of the Sub-Committee of the Advisory Board appointed to report separately upon the following points :—

(1) The question of the preparation and application of all *sera*.

(2) The question of the preparation and application of anti-typhoid fluid, including a report upon the results of inoculations against enteric fever in the Army, so far as they can be ascertained.

Adopted as a Report of the Board to the Secretary of State, September 25th, 1902.

(1) In advising the Board upon the preparation and application of sera, the Sub-Committee expresses the opinion that, as a general principle, it is undesirable that therapeutic agents of any kind, which may be obtained from ordinary commercial sources, should be manufactured by the Army Medical School or its professors. At the present time the sera which possess admitted therapeutic value (*e.g.*, diphtheria antitoxin) are to be procured from several reputable firms, and there is no reason to suppose that their direct preparation by the Army Medical School would result either in economy to the State or in the production of a purer or better article, whilst it is certain that much valuable time, which in the opinion of the Sub-Committee would be better devoted to teaching or research, is thus lost to the professors of the School. It has, however, been urged that, even from the teaching point of view, it is most important that officers of the Royal Army Medical Corps, whilst attending courses of instruction in the Medical Staff College, should gain a practical acquaintance with the actual manufacture of antitoxins, and, indeed, should themselves be in a position to undertake their preparation. This contention the Sub-Committee does not find itself able to accept. Whilst admitting that the general principles underlying serum therapy should be taught to Royal Army Medical Corps officers, as indeed they are already taught to advanced students in Medical Schools, they feel that it would be distinctly not without risk to encourage officers on the strength of a short course of instruction to undertake work for which special aptitude and continuous practice are required. Sera so prepared might, indeed, prove to be of lethal, rather than of therapeutic, potency, and it is open to doubt whether any patient would knowingly submit himself for injection with such fluids. In saying so much the Sub-Committee must not be understood as expressing an opinion adverse to researches by professors of the School having for their object the discovery of new therapeutic sera; on the contrary, they are in favour of allowing to professors, and to those Royal Army Medical Corps officers who obtain special study leave, very considerable latitude in their choice of subjects for investigation,

but there is obviously a wide difference between such researches and what is practically the manufacture of sera on a commercial scale. As regards the professors of the School, the opinion cannot be too strongly emphasised that their first object should be to fulfil the duties for which they were primarily appointed, namely, to give thoroughly efficient and practical teaching to the officers placed in their charge; and having thus fulfilled their duty to the Corps, they should be granted all needful facilities for original investigations, whether in serum therapeutics or in other fields of endeavour. A careful review of circumstances, as they now exist, induces the Sub-Committee to make the following recommendations: (*a*) That it is inexpedient that the preparation of therapeutic agents for distribution to the Naval and Military Services should be undertaken by the Army Medical School. (*b*) That the preparation of sera, anti-diphtheritic or other, at present carried on at Netley be discontinued.

(2) Upon the further question referred to it, namely, the preparation and application of anti-typhoid fluid, the Sub-Committee finds itself in some difficulty, in as much as the efficacy or otherwise of this prophylactic remedy is still in dispute. For the purpose of dealing with the statistics at present available, the Sub-Committee asked Lieutenant-Colonel Bruce to prepare the paper which forms the appendix to this Report, and it does not know that more can be done in this direction until the publication of what is understood to be contemplated by the Army Medical Department, namely, a detailed comparison of the lists of inoculated soldiers, with the names in the admission and discharge books of the South African War. The Sub-Committee is informed that this report cannot be completed in less than three years or thereabouts, and even when it appears it will be open to question whether the diagnoses made in the field and base hospitals are sufficiently accurate to enable trustworthy conclusions to be drawn from them. Adopting, however, for the present, Lieutenant-Colonel Bruce's conclusions, which coincide generally with opinions gathered from various civilian physicians and surgeons who have lately returned from South Africa, the Sub-Committee recommends: (*c*) That for the present the preparation and distribution of enteric prophylactic fluid by the Army Medical School should be suspended.

In coming to this conclusion the Sub-Committee is largely influenced by the admission made by the Professor of Pathology in the Army Medical School, that the inoculation of troops with prophylactic fluid shortly before reaching an area where enteric fever is rife, renders certain individuals more prone to acquire the disease, and consequently, so far as these individuals are concerned, increases the peril to life. There is, in the opinion of the Sub-Committee, no question that if this be the case, anti-typhoid inoculations should be performed, if performed at all, under very careful safeguards, having regard to the fact that though the operation is stated to be voluntary upon the part of the soldiers who submit to it, the sentiment of military discipline may readily cause it to

be in practice compulsory. There is, indeed, no doubt that public opinion would severely condemn any system of compulsory inoculation which, though it might obtain some measure of protection for the majority, was admitted to entail upon a certain number of individuals increased liability to disease, suffering and death. Until further light is thrown upon this, and many other questions connected with the use of anti-typhoid fluid, it is from every point of view expedient that the present practice of extensive inoculations should be suspended.

If it is considered desirable to resume this system of prophylaxis in the army, the Professor of Pathology should be asked to present to the Board a detailed scheme, showing exactly on what lines, and with what precautions, he would propose that the system should be carried out.

APPENDIX.

Analysis of the Results of Professor Wright's Method of Anti-Typhoid Inoculation. By David Bruce, Lieutenant-Colonel, R.A.M.C.

Part 1.—Summary of previous reports, from 1896 to 1902.

Part 2.—Analysis of Dr. Dodgson's report on the result of investigations carried out at military hospitals in South Africa, with reference to the results of anti-typhoid inoculation among the troops.

Part I.

Professor Wright began his method of anti-typhoid inoculation in the summer of 1896, and noted his first results in the *Lancet* of September 19th of the same year.

On January 30th, 1897, in conjunction with Surgeon-Major Semple, he communicated a paper to the *British Medical Journal*, entitled, "Remarks on Vaccination against Typhoid Fever." In it he described the method of preparing the anti-typhoid vaccine, the dosage, the clinical systems which supervene in man after inoculation, and the effect on the blood.

This last was gauged by testing the serum from the inoculated person with typhoid bacilli, and noting the dilution at which agglutination took place. This reaction, known generally at the present time as Widal's, seems to have been taken at first as a proof and even a measure of immunity. The lapse of time and further knowledge, however, have not strengthened this hypothesis, which may now be said to have been abandoned by Professor Wright in favour of an examination of the blood as to its power of destroying bacilli—its bactericidal action.

In the autumn of 1897 Professor Wright is reported to have had an interview with the Commander-in-Chief on the subject of immunising the troops against enteric.

In March, 1898 (*Lancet*), there is an account of the result of anti-typhoid inoculation in the Kent County Asylum.

On an outbreak of enteric fever occurring among the inmates, Surgeon-Major Semple, R.A.M.C., at once proceeded there. All the medical staff and a number of attendants were inoculated. It is stated that not one of those vaccinated, 84 in number, contracted the disease; while of those who refused vaccination, numbering 120 and living under similar conditions, 16 were attacked. This is represented in the following table:—

—	Number	Cases of Enteric	Incidence	Deaths	Case Mortality
Uninoculated ..	120	16	13·3	—	—
Inoculated	84	—	—	—	—

Another account of the same epidemic appeared on June 2nd, 1900, entitled, "Preventive Inoculation against Typhoid Fever," by A. G. R. Fullerton, F.R.C.S.

—	Number	Cases of Enteric	Incidence	Deaths	Case Mortality
Uninoculated ..	46	4	8·7	—	—
Inoculated	84	—	—	—	—

Professor Wright gives still different figures in his paper on "The Results which have been obtained by Anti-typhoid Inoculation," which appeared in the *Lancet*, September 6th, 1902.

—	Number	Cases of Enteric	Incidence	Deaths	Case Mortality
Uninoculated ..	116	4	1·34	—	—
Inoculated	84	—	—	—	—

The figures 1·34 are evidently wrong and should be 3·4.

N.B.—In these and the following tables no notice is taken of the total strength. The object of this analysis is to compare, in the first place, and more especially the incidence of, typhoid fever among the inoculated and uninoculated members of a community exposed as much as possible to the same conditions, and secondly, the case mortality among the same classes. It is to be noted that all the tables in this analysis are made in the same way, and that the incidence and case mortality are always in the ratio of 1 in 100.

In January, 1899 (*British Medical Journal*), there is a note of Professor Wright having inoculated 250 of the West Riding Regiment at Bangalore, and also of having inoculated troops at Rawal Pindi.

In regard to India, it appears from a Parliamentary paper that these

anti-typhoid inoculations having been carried out without the sanction of the Government of India or the Commander-in-Chief, orders were given to stop the inoculations, and the treatment was accordingly abandoned.

Soon afterwards, however, the Government of India wrote to the Secretary of State for India recommending the resumption of the method, and enclosing a communication from the Principal Medical Officer, which stated that, "from experiments which had been carefully made it has been conclusively proved, to the satisfaction of those who are best competent to judge of the matter, that the anti-typhoid inoculation, when properly carried out, achieves an immunity equal to or greater than that which accrues to a person who undergoes and recovers from an attack of that disease."

In August, 1899, the Secretary of State for India approved the resumption of the method.

Later on, in the same year (1899), we find that the practice of anti-typhoid inoculation is being carried out extensively among the troops proceeding to South Africa, among units previously stationed there, and also among those which had recently arrived in Natal from India.

January 20th, 1900 (*British Medical Journal*). "The results which have been obtained by anti-typhoid inoculation, and the methods which have been employed in the preparation of the vaccine," is the title of a paper written by Wright and Leishman.

The following table of statistics, gathered from some fourteen different regiments serving in India, is taken from this paper, and shows the results:—

—	Number	Cases of Enteric	Incidence	Deaths	Case Mortality
Uninoculated ..	8,460	213	2·5	23	10·8
Inoculated	2,835	27	0·95	5	18·5

Statistics of anti-typhoid inoculation, published by Professor Wright in the "Army Medical Report" for 1900. These official returns give for the British Garrison in India:—

—	Number	Cases of Enteric	Incidence	Deaths	Case Mortality
Uninoculated ..	54,554	731	1·34	224	30·6
Inoculated	5,999	52	0·87	8	15·4

July 14th, 1900 (*Lancet*). A note published by Professor Wright on statistics collected at Ladysmith during the siege.

OFFICERS.

—	Number	Cases of Enteric	Incidence	Deaths	Case Mortality
Uninoculated ..	171	43	25·1	5	11·6
Inoculated	44	9	20·4	2	22·2

OFFICERS, NON-COMMISSIONED OFFICERS AND MEN.

—	Number	Cases of Enteric	Incidence	Deaths	Case Mortality
Uninoculated ..	10,529	1,489	14·14	329	22·1
Inoculated	1,705	35	2·05	8	22·8

NAVAL BRIGADE AT LADYSMITH.

—	Number	Cases of Enteric	Incidence	Deaths	Case Mortality
Uninoculated ..	286	66	23·1	28	42·5

In September, 1900, in the *Indian Medical Gazette*, appears the following table showing the results of anti-typhoid inoculation in the Indian Army during 1899 :—

—	Number	Cases of Enteric	Incidence	Deaths	Case Mortality
Uninoculated ..	25,851	657	2·54	146	22·1
Inoculated	4,502	44	·98	9	20·4

January 18th, 1902 (*Lancet*). "Typhoid Fever in South Africa," by Elliot and Washbourn.

DEELFONTEIN.

—	Number	Cases of Enteric	Incidence	Deaths	Case Mortality
Uninoculated ..	—	186	—	20	10·7
Inoculated	—	25	—	4	16·0

PORTLAND HOSPITAL.

—	Number	Cases of Enteric	Incidence	Deaths	Case Mortality
Uninoculated ..	—	178	—	25	14·0
Inoculated	—	54	—	4	7·4

PRETORIA.

—	Number	Cases of Enteric	Incidence	Deaths	Case Mortality
Uninoculated ..	—	115	—	6	5·2
Inoculated	—	27	—	—	—

Dr. Tooth, on March 16th, 1901 (*British Medical Journal*), gives statistics relating to the staff of the Portland Hospital in South Africa.

—	Number	Cases of Enteric	Incidence	Deaths	Case Mortality
Uninoculated ..	13	3	23·0	1	33·3 %
Inoculated	28	7	25·0	—	—

Cases treated in the Portland Hospital:—

OFFICERS.

—	Cases of Enteric	Deaths	Case Mortality
Uninoculated ..	13	1	7·7
Inoculated	21	—	—

NON-COMMISSIONED OFFICERS AND MEN.

—	Cases of Enteric	Deaths	Case Mortality
Uninoculated ..	165	24	14·55
Inoculated	33	4	12·12

April 20th, 1901 (*British Medical Journal*). "Medical Notes from the Imperial Yeomanry Hospital," by Dr. Washbourn.

"Inoculation.—With regard to the value of inoculation, I am satisfied, from clinical observations, that it does not modify the disease. Mild, severe, and fatal cases occur among the inoculated and uninoculated, and, as far as one can judge, with the same frequency. Whether inoculation diminishes the incidence of enteric fever can only be determined by extensive statistics. From my own personal experience I should not think that the incidence is diminished. It is possible that inoculation protects for a few months, and that it may thus be of some limited utility, but in view of the pain and inconvenience caused by inoculation, I cannot feel that it will be of much practical value in the future. In this connection I may note that I have observed a not inconsiderable number of second attacks of enteric occurring within a year, and in one case, at least, the second attack was fatal."

In the *Lancet* of February 9th, 1901, there is a paper by Professor Wright, entitled, "A Note on the Results obtained by Anti-typhoid Inoculations in the 15th Hussars, Meerut, India, from October 22nd, 1899, to October 22nd, 1900."

No cases occurred among the officers or women.

—	Number	Cases of Enteric	Incidence	Deaths	Case Mortality
Uninoculated ..	164	11	6·7	6	54·5
Inoculated	317	2	·6	1	50·0

In the *Scottish Medical and Surgical Journal* for March, 1901, there is a paper on "The Edinburgh Hospital in South Africa, and its Work," in which the following figures bearing on this question are given:—

—	Number	Cases of Enteric	Incidence	Deaths	Case Mortality
Inoculated	58	9	15·5	1	11·1

In the *Lancet*, page 1272, appears a "Note on the Results obtained by the Anti-typhoid Inoculations in Egypt and Cyprus, during the Year 1900," by A. E. Wright.

EGYPT AND CYPRUS, 1900.

—	Number	Cases of Enteric	Incidence	Deaths	Case Mortality
Uninoculated ..	2,669	68	2·1	10	14·7
Inoculated	720	1	·13	1	100·0

MALTA.

—	Number	Cases of Enteric	Incidence	Deaths	Case Mortality
Uninoculated ..	2,456	17	0·69	5	29·4
Inoculated	61	—	—	—	—

April 20th, 1901. Report on 295 cases of enteric fever treated in the General Hospital, Ladysmith :—

—	Number	Cases of Enteric	Incidence	Deaths	Case Mortality
Uninoculated ..	—	265	—	5	1·86
Inoculated	—	30	—	2	6·67

Cases treated in the Stationary Hospital, Harrismith :—

—	Number	Cases of Enteric	Incidence	Deaths	Case Mortality
Uninoculated ..	—	947	—	135	14·3
Inoculated	—	263	—	18	16·8

"Note on the Result of Anti-typhoid Inoculation in the case of the 5th Battalion Manchester Regiment, in South Africa," by A. E. Wright, M.D.Dublin (*Lancet*, April 5th, 1902) :—

—	Number	Cases of Enteric	Incidence	Deaths	Case Mortality
Uninoculated ..	547	23	4·2	7	30·4
Inoculated	200	3	1·5	—	—

"Some Statistics Regarding the Effect of Inoculation Against Typhoid Fever in South Africa," by Alexander Crombie, M.D. (*Lancet*, May 3rd). First series (taken from convalescent officers appearing before Medical Board) :—

—	Number	Cases of Enteric	Incidence	Deaths	Case Mortality
Uninoculated ..	109	24	22·0	—	—
Inoculated	112	32	28·5	—	—

Officers invalided from South Africa. Second series:—

—	Number	Cases of Enteric	Incidence	Deaths	Case Mortality
Uninoculated ..	85	28	32·9	—	—
Inoculated	102	34	33·3	—	—

The following five tables are taken from Professor Wright's paper, "The Results which have been obtained by Anti-typhoid Inoculation," *Lancet*, September 6th, 1902:—

City Imperial Volunteers, South Africa.

—	Number	Cases of Enteric	Incidence	Deaths	Case Mortality
Uninoculated ..	494	39	7·9	11	28·2
Inoculated	700	60	8·5	9	15·09

Patients in Richmond Asylum, Dublin.

—	Number	Cases of Enteric	Incidence	Deaths	Case Mortality
Uninoculated ..	296	30	10·0	4	13·39
Inoculated	339	6	1·8	1	16·6

Patients in the Irish Hospital, South Africa.

—	Number	Cases of Enteric	Incidence	Deaths	Case Mortality
Uninoculated ..	—	592	—	74	12·5
Inoculated	—	80	—	5	6·25

Staff of the Imperial Yeomanry Hospital, Deelfontein.

—	Number	Cases of Enteric	Incidence	Deaths	Case Mortality
Uninoculated ..	25	4	16	—	—
Inoculated	59	4	6·8	—	—

7th Hussars, South Africa.

—	Number	Cases of Enteric	Incidence	Deaths	Case Mortality
Uninoculated ..	244	20	8·2	3	15·0
Inoculated	307	9	2·9	—	—

Part II.

Analysis of Dr. Dodgson's report on the result of investigations carried out at the military hospitals in South Africa, with reference to the results of anti-typhoid inoculation among the troops.

(These statistics were collected during a period of eight months, June to November, 1900, February to March, 1901).

In analysing these results I have separated them into :—

(*a*) Statistics which show the incidence of the disease among the healthy.

(*b*) Statistics which show the case mortality among the inoculated and uninoculated enteric cases.

(*a*) In trying to gauge the benefit of anti-typhoid inoculation in an army in the field, it is the incidence of the disease among the troops which is of primary importance. The question is, what proportion of inoculated troops, as compared with the uninoculated, take enteric fever, rather than what is the case mortality among the two classes of enteric sick.

The goal to be striven for in anti-typhoid inoculation in armies is to prevent the incidence of enteric fever among the healthy. The case mortality among the enteric sick is of secondary importance from a military point of view. At the same time, in the tables showing the incidence, the case mortality is also given, as this is, of course, of great general interest.

(1) Incidence and Case Mortality among the Non-Commissioned Officers and Men at No. 8 General Hospital, Bloemfontein.

—	Number	Cases of Enteric	Incidence	Deaths	Case Mortality
Uninoculated ..	110	44	40·0	8	18·1
Inoculated	21	5	23·8	—	—

Remarks.—Dr. Dodgson gives several tables in connection with this hospital, but as he considers the others are open to very serious fallacy I have left them out, as it seems to me I shall only complicate this analysis if I bring in material which is confessedly full of errors. This table he states is the one least open to fallacy.

In a unit of 131 men, two-fifths of the uninoculated and one-fourth of the inoculated took the disease. The first thing that strikes one is the enormous incidence, even among the inoculated. Unless some system of prevention can be devised which will give better results than this, it is difficult to see that it can be of very great use. If every man of an army of 100,000 men was inoculated, yet the General would be liable to have 25,000 placed *hors de combat* within the first few months.

It is true that the inoculated seem to be in a more favourable position than their neighbours. But what can one do with such a small number

as twenty-one. If by chance three more cases had happened among them, then the percentage of incidence among the two classes would have coincided. There are so many fallacies. Take, for instance, the fallacy of diagnosis. In South Africa it is impossible to diagnose the cases of enteric with any complete degree of accuracy, even in time of peace. In this hospital Dr. Dodgson states that he found it impossible to check the diagnosis himself, as "but few notes had been kept, and the temperature charts had been mostly mislaid."

In regard to the case mortality, five is a number too small for statistical purposes. If one death had occurred among the inoculated, which is not hard to imagine, then the percentage would have at once jumped up to 20 per cent., *i.e.*, 2 per cent. above the uninoculated.

(2) Incidence and Case Mortality among the Non-Commissioned Officers and Men of No. 9 General Hospital.

—	Number	Cases of Enteric	Incidence	Deaths	Case Mortality
Uninoculated ..	47	13	27·6	2	15·4
Inoculated	87	11	12·6	1	9·1

The remarks made in regard to No. 8 General Hospital are equally applicable here. I would add that an incidence rate of almost 13 per cent. among the inoculated staff of a presumably sanitary and well-managed general hospital is very high, even though it is less than half that of the uninoculated.

(3) Incidence and Case Mortality among Nineteen Members of the Staff of No. 5 Stationary Hospital, Exposed to the Same Conditions for Ten Months.

—	Number	Cases of Enteric	Incidence	Deaths	Case Mortality
Uninoculated ..	14	3	21·4	—	—
Inoculated	5	3	60·0	1	33·3

This table shows well the fallacy of small numbers. Here the incidence among the inoculated is three times as great as among the uninoculated, and the case mortality is as 33·3 to *nil*.

(4) Incidence and Case Mortality among the Sisters of the Imperial Yeomanry Hospital, Pretoria.

—	Number	Cases of Enteric	Incidence	Deaths	Case Mortality
Uninoculated ..	38	3	7·8	—	—
Inoculated	12	2	16·6	—	—

Here again the uninoculated are more fortunate than their inoculated sisters.

(5). Incidence and Case Mortality among the Orderlies of the Imperial Yeomanry Hospital.

—	Number	Cases of Enteric	Incidence	Deaths	Case Mortality
Uninoculated ..	34	4	11·6	—	—
Inoculated	20	1	5·0	—	—

Remarks.—This table is in favour of the inoculated, but the numbers are again small.

(6). Incidence and Case Mortality among the Staff of No. 10 General Hospital.

—	Number	Cases of Enteric	Incidence	Deaths	Case Mortality
Uninoculated ..	119	36	30·2	6	16·6

Quoting from Dr. Dodgson's report, "There was no inoculation amongst the members of the original staff," but "An analysis of cases of enteric fever has, however, been made, as it forms an interesting comparison" with the previous tables.

(*b*) Analysis of Dr. Dodgson's statistics, relating to the case mortality among the uninoculated and inoculated enteric sick.

Naturally in a time of war this was almost the only kind of evidence available. The regiments were constantly on the move, were constantly being broken up, and their sick were often treated in many different hospitals. Even the medical officer in charge of a regiment would have little or no opportunity of gaining knowledge on this subject, as he lost sight of his patients as soon as they reported sick, and he could, in most cases, only guess at the time at the diagnosis.

(1). Analysis of Cases of Enteric Fever at No. 6 General Hospital.

—	Cases of Enteric	Deaths	Percentage
Uninoculated ..	477	58	12·1
Inoculated ..	50	5	10·0

As will be seen, the death-rate in the two classes is very close. In the latter or inoculated class there are only fifty cases and five deaths. The addition of another single death among the inoculated would equalise the death-rate of the two classes.

Further, it is stated that there were 174 unnoted cases which could not be placed. The death-rate among them was 21·8 per cent. This high mortality was due to the fact that this unnoted class included all those brought into the hospital in a dying condition, and from whom, of course, no information could be obtained.

Again, Dr. Dodgson informs us that the percentage of very severe cases is greatest among the inoculated. It is probable, then, that some of the cases brought into hospital in a dying condition belonged to the inoculated class, and as shown above the addition of one or two fatal cases to the inoculated would make a great difference in the respective ratios.

Taking everything into consideration, I am of opinion that this table, giving the analysis of cases at No. 6 General Hospital, tends to show that the effect of anti-typhoid inoculation in case mortality is quite neutral. I leave out any allusion to Dr. Dodgson's further manipulation of these figures into various classifications, as I do not think it would strengthen, but rather weaken, the case for the inoculated.

Dr. Dodgson's own conclusion is that, on the whole, there is little to distinguish the inoculated from the uninoculated cases, as regards death-rate, severity of disease, the incidence and severity of complications, the differences being so small as to easily come within "errors of observation."

(2). No. 5 Stationary Hospital.

—	Cases of Enteric	Deaths	Percentage
Uninoculated ..	53	8	15·0
Inoculated ..	24	2	8·3

(3). No. 1 General Hospital.

—	Cases of Enteric	Deaths	Percentage
Uninoculated ..	194	22	11·3
Inoculated ..	32	6	18·8

(4). No. 2 General Hospital.

—	Cases of Enteric	Deaths	Percentage
Uninoculated ..	202	31	15·3
Inoculated ..	28	3	10·7

(5). Analysis of 136 Cases at the Orange River Hospital, by Major Moffett, R.A.M.C.

—	Cases of Enteric	Deaths	Percentage
Uninoculated ..	109	22	20·1
Inoculated ..	27	1	3·7

(6). Analysis of Cases at No. 9 General Hospital, Bloemfontein, by Major Yarr, R.A.M.C.

—	Cases of Enteric	Deaths	Percentage
Uninoculated ..	586	64	10·9
Inoculated ..	387	32	8·2

Conclusions.

(1) The general statistics available up to the present are not sufficiently extensive or exact to permit of any conclusions being drawn as to the utility of Wright's anti-typhoid inoculation.

(2) Dr. Dodgson's statistics are of no value in trying to form an estimate of the effect of anti-typhoid inoculation on the incidence of the fever among the troops, on account of the smallness of the numbers employed.

(3) His results are also of little or no value in estimating the case mortality; but if any conclusion can be drawn from them, it is that the case mortality is not affected by the inoculation.

(4) No trustworthy statistics can be hoped for from the troops employed in South Africa during the present war.

(5) Although the future of anti-typhoid inoculation does not appear to be very bright, yet in view of the enormous importance of the subject and the possibility, when the method is further developed, of its exerting a practical diminution in the incidence of typhoid fever in armies, the study of this system of prevention should be persevered in.

(6) In future these inoculations, if continued, should be carried out under strict supervision and on a properly constituted basis.

(7) To lay down these regulations I would suggest that the subject be brought before the Advisory Board.

(8) Possibly the best way to collect trustworthy evidence in the future would be to inoculate as nearly as possible 50 per cent. of each regiment or unit proceeding to a station where the disease is endemic. This should be performed by a skilled medical officer at least three months before embarkation.

(9) Inoculation in presence of an epidemic, or even after arrival in an endemic area, ought to be discontinued.

(10) The practice of inoculating troops on board transports should also be discontinued.

Reviews.

"The Prevention of Disease in Armies in the Field." By Major Robert Caldwell, F.R.C.S., D.P.H., R.A.M.C.

This work forms a handy volume of 182 pages, and was awarded the Parke's Memorial Prize at the recent triennial competition. The author may be congratulated on the production of a book that is evidently the result of considerable experience in many countries and climates, including active service in two campaigns; the fruit of which he now puts forward "in the hope that what is, in the main, a record of sanitary experience in the field may possibly prove of some interest to those whose attention is particularly drawn to the physical well-being of the soldier." This is a very modest claim, and we consider that a study of this book will be not only of interest, but also of profit, to his brother officers of the Royal Army Medical Corps, and all others who have to deal with the subject matter of the essay.

The author treats of Diseases of the Soldier in the Field, Administrative Matters Affecting the Health of Troops in the Field, Sanitary Measures in the Field, and the Sanitary Organisation of a Field Force. In each chapter, whatever is written is written as the outcome of personal experience; there is little reference to the statements of others, and there is an entire absence of "padding."

Concerning the perennial subject of Enteric Fever in the Field, Major Caldwell has some interesting facts to relate regarding outbreaks on the Nile in 1885, and at various places in South Africa during the late war. In each case he shows that soil pollution was much more probably the means of spread of the disease than a polluted water supply. Speaking of dysentery, he observes that "there is reason to believe that its powers for evil persist in the soil of certain localities after all sources of pollution have been removed, with a tenacity which is unknown in the case of enteric fever" (p. 31). At Tyger Kloof "careful sanitation had been followed by excellent results as regards stamping out the spread of enteric fever, while in spite of every possible precaution, it was impossible to do the same as regards dysentery" (*ib.*). Again, about three weeks after the relief of Ladysmith, a unit was encamped to the north of that town on ground which had previously been occupied by a Boer laager; dysentery broke out almost immediately after their arrival; it was known that the Boers had suffered both from dysentery and enteric fever while camped on this ground; the only disease they appear to have left behind them was dysentery. A similar experience was met with at Glencoe in the Biggarsberg, when a Boer laager was occupied after some days by British troops (p. 32). This suggestion is worth following up; as for the viability of the enteric bacillus in soil, it has been found to survive for many months, even ten months, in organically polluted soil (Robertson); so that it would not have been surprising if our troops had suffered from enteric in the above instances; as a matter of fact they did so suffer, but the dysentery appears to have been more *en evidence*.

Two cases of "food poisoning" are related from the author's personal experience; in one case the attack supervened within an hour, or less, of consuming a "preserved field ration;" the symptoms were violent purging and vomiting, cramps and collapse, all of which passed off comparatively soon (p. 38). These so-called ptomaine poisoning cases are of much interest and importance, now that the consumption of preserved food is so large. Since Delépine's researches in the Derby outbreak in 1902, it appears that a bacterial poison is to be suspected even in cases of such rapid development as that just mentioned.

Speaking of enteritis, which the author acknowledges to be a vague term, he directs attention to the marked mental depression that (according to his experience) commonly occurs; "both officers and men who were by no means emotional under ordinary circumstances, and who were noted for general smartness," being "rapidly reduced to a condition of lachrymose fatuity and self-pitying abandonment, which it was most distressing to witness" (page 49). It is suggested that the disease consists essentially of some form of general poisoning of which the intestinal flux is only a symptom.

In discussing various Administrative Matters Affecting the Health of Troops in the Field, Major Caldwell condemns the practice of digging deep latrine trenches, and shows that shallow trenches (not more than one foot deep) are more scientific. For ground in prolonged occupation he advocates a pail system of removal, and adduces an instructive comparison. "At Tyger Kloof camp, where latrine buckets were introduced, and where refuse was removed absolutely from the precincts of the camp, enteric fever in the early part of 1902 was, in my experience, almost unknown; while Dyson's Farm, about five miles distant, was a hotbed of the above disease. The soil at the last-named post was absolutely saturated with filth, largely of fæcal origin" (p. 75). We will assume that the facts are as stated; cause and effect *may* not be in the direct relation to each other that the author indicates; but if some twenty, or fifty, observations of this kind were forthcoming—as might easily be the case if medical and other officers would note down *facts* at the time, and not trust to general impressions arrived at subsequently—a general induction could be made that would be of value. It is, of course, a common-place to say that the soil of a camp should be kept free from pollution as much as possible; if, however, it were a fact actually demonstrated beyond possibility of contradiction, that enteric fever and dysentery prevailed in polluted camps and were absent from clean camps, the general body of officers would be more alive to the necessity for carrying out the regulations as to the prevention of soil pollution. The water question must, of course, always be borne in mind, but the soil should receive an equal share of attention.

The chapter on Sanitary Measures in the Field is full of practical suggestions. The importance of a careful inspection of men as to their fitness (and especially in the case of reservists), points in camp conservancy, sick transport, isolation; the efficacy of boiling water (immersion of articles of clothing for thirty seconds) as a disinfectant; the inexpediency of an alcohol ration; the importance of medical inspections at the dinner hour, to see to the character of the cooking, &c., are only a few out of many topics dealt with.

The following is worth noting in relation to *boots*: "The newest form

of boot has the sole fastened to the upper by means of screws, the boot being made by machinery. Army shoemakers state that the machine by which the screws are inserted works with such force that the soles are compressed into the consistence of a board, and the result is that movement of the transverse tarsal articulation is impeded, and the foot has, more or less, to be lifted as a whole. Men state that they much prefer the old 'clumper' boot for comfort. . . . Men state that the former boot causes considerable pain across the arch of the foot after some hours' use, besides which blisters appear to be readily induced" (p. 128). With regard to the articles of clothing generally, the author has nothing but praise.

Major Caldwell makes a good suggestion in regard to the early notification of any special incidence of disease in a unit, or units; it entails the preparation of two new forms, but they would be of great practical use; examples are given on pp. 142 and 148; the following illustration makes their meaning clear: "The medical officer in charge of a regiment reports that fifteen cases of diarrhœa, accompanied by high temperature, have occurred during the week. The cases have occurred in two companies only, and on enquiry it is found that one of these companies has neglected to filter the water for drinking purposes, and that in the other the sterilisation of the candles has been omitted. Returns rendered from the lines of communication, in accordance with the form suggested, show that twelve out of the original fifteen cases have been [subsequently] diagnosed enteric fever. The general sanitation of the camp is excellent, and the water supply, as far as taste, smell, and general appearance goes, is perfectly satisfactory. It is drawn, however, from a stream which flows past a deserted camping ground about a mile from the source of supply. Bacteriological examination at the laboratory reveals the presence of *B. coli* and *B. enteritidis sporogenes*. *B. typhosus* is not found, but the evidence of fæcal pollution is clear. It is evident that no part of this story can be omitted without destroying its completeness, and the value of such a record cannot be doubted" (p. 151).

The question of the subordinate sanitary staff that will require to be trained and organised for field service receives attention. Action has already been taken in the direction indicated, and classes of N.C.O.'s and men of the R.A.M.C. are being specially instructed in general hygiene, barrack and camp sanitation, and laboratory work; some candidates have successfully passed the public examinations for sanitary inspectors held by the Royal Sanitary Institute. In this way a career is opened up for them on their retirement into civil life. This new departure may have a most beneficial influence on recruiting for the Corps.

In a concluding chapter the author sums up as follows:—

(1) "That, apart altogether from endemic causes, certain conditions attendant on field service are potent factors in the production of disease."

(2) "That among disease-producing factors soil pollution occupies a prominent place."

(3) "That, although the existence of water-borne enteric fever is beyond doubt, other factors—notably soil pollution—are of as powerful a nature as the first named in a like direction."

(4) "That the best means of water purification are not known with certainty." The author inclines to favour the Berkefeld filter, as the best means known at present, but admits that it is not free from grave objections.

(5) "That, as so many cases of so-called simple continued fever are undoubtedly enteric fever, and as these unrecognised cases are active agents in the spread of the latter disease, means for carrying out the serum diagnosis should be given as wide a field as possible of general applicability."

(6) "That the prevention of disease in an army in the field resolves itself largely into the question of the disposal of organic refuse."

(7) "That the spread of epidemic sickness in the field is largely the result of the presence in field hospitals of patients suffering from forms of communicable disease." The author considers that such cases should be treated in hospitals at the base, or on line of communications, and not up at the front.

(8) "That, with a few common-sense exceptions, the excreta of all patients in field hospitals should be sterilised."

(9) "That, as far as is consistent with military exigencies, autonomy should be granted to the medical service of the army as regards sick transport."

These are the most important of Major Caldwell's conclusions, and we consider that, on the whole, they are well grounded.

The book is well printed, has some reproductions from photographs by way of illustration, and is almost free from typographical errors. We notice on page 14 the expression in footnote, "nitrification is only the final state of the process of reduction"; and on page 15, "basic nitrates which might be present as a result of the reduction by soil organisms of organic matter." The meaning is obvious; a breaking up, or breaking down, of complex organic bodies into simple inorganic compounds; but as this is, in this instance, an oxidising process (which is the converse of a reducing process) the expression "reduction" is not convenient.

In conclusion, this book may be strongly recommended to Army Medical Officers, as well worthy of their attention, and well adapted to advance the successful practice of sanitation in the field. All the measures advocated may not be practicable at the moment, but the word "impossible" must be erased from our vocabulary. Commanding officers and combatant officers generally, will in the future pay much more attention to sanitary matters than heretofore. In the United States Army, we understand that, in camp, for a man to urinate anywhere but in a latrine, trench, or bucket, is a military offence, liable to be followed by severe punishment; and this month we learn from Miss McCaul, that in the Japanese army in the field, water-boiling is carried on systematically and successfully, and that "there is a stringent discipline about troops found drinking or filling a water bottle at a river. If a man is caught disobeying the order, a mark is put against him, and at a convenient time punishment is meted out; also it is noted as a serious crime at headquarters" ("Under the Care of the Japanase War Office.") If other armies can check camp pollution and secure that only pure water is drunk, by means of effective disciplinary administration, why cannot we do the same? It is *not* impossible, but perseverance is needed, *ohne hast, ohne rast;* here a little, there a little; precept upon precept, line upon line.

A. M. Davies.

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"THE SURGERY OF THE DISEASES OF THE APPENDIX VERMIFORMIS AND THEIR COMPLICATIONS." By William H. Battle, F.R.C.S., and Edred W. Corner, M.B., B.C., F.R.C.S. London: Constable and Co., 1904.

This little volume aims at providing a *résumé* of the literature of Diseases of the Vermiform Appendix. The task that the authors have set themselves has been admirably done. The book is concise, well arranged and well written. Those who lack the leisure to master the very large series of monographs and articles which have been written on this subject, will find in the present volume a very useful *précis* of a copious mass of facts and theories. The book, however, is no mere compilation. It presents a valuable series of statistics derived from the records of St. Thomas's Hospital, as well as much original matter in the departments both of pathology and of treatment. The chapters on the history of the disease and on the anatomy and physiology of the appendix are necessarily very brief. The chapter on the development of the organ is briefer still, and contains the statement—to which many will object—that a distinctly marked appendix is to be found in the opossum.

Dealing with the ample statistics of St. Thomas's Hospital, the authors note that "70 per cent. were in their first attack, 20 in their second, and 10 in their third or more. The percentage of those which had a second or more attacks is therefore 30. The mortality, however, was very different; that for the first attack was 25, that for the second 7, that for the third 2."

In the account of the bacteriology and pathology of appendix a good *résumé* of well-known facts is given. On the subject of the association of appendicitis with colitis and typhlitis the authors write as follows: "It is well known that the tonsils undergo fibrosis or chronic inflammation without the occurrence of an acute attack. In like manner do similar changes occur in the appendix. Fibrosis of the appendix interferes with the completeness of its peristaltic action, and as a result the tube becomes incapable of emptying itself. By this means a vicious circle is established, in that more pabulum remains within for the bacteria to flourish upon, and the more bacteria flourish, the more likely is it that the chronic inflammation will progress and the organ become still more incapable of performing its own evacuation. . . . The fibrosis and its subsequent contraction leads to the disappearance of the lymphoid follicles and the further impairment of the muscular action. The appendix consequently becomes the next breeding ground for bacteria, and if the products of their action escape into the cæcum the multiplication is continued there." In this way is produced a chronic typhlitis which may in its turn lead to a colitis of the whole length of the large bowel. The authors consider that "many of the instances of dyspepsia, constipation, mucous colitis, abdominal discomfort, &c., are of this origin."

Speaking of that form of acute appendicitis "where the mucous membrane is uniformly red and the changes are confined to that part," the authors remark, "the likeness of these cases, both clinically and pathologically, to erysipelas has led one to regard many attacks of acute appendicitis as examples of capillary lymphangitis of the mucous membrane, or erysipelas, just as cutaneous erysipelas is a capillary lymphangitis of the skin." On the question of the value of leucocytosis in appendicitis the following conclusions are given:—

(1) "The leucocyte count is valuable in the prognosis; the greater the increase the greater the likelihood of obvious purulent complications.

(2) "An increasing, or a stationary and high leucocytosis demands operation.

(3) "A decreasing or a stationary and low leucocytosis is safe. The import of the last two points must always be taken in conjunction with clinical symptoms.

(4) "There may be no leucocytosis with mild inflammations, chronic inflammations, extremely fulminating cases, extremely chronic and localised abscesses, &c.

(5) "It serves as an indication of the necessity of operation from the patient's point of view, and so is of value in deciding the question of immediate operation."

In the sections on treatment the authors declare against indiscriminate operation or, as many advise, operation as soon as the diagnosis is made. They point out that the majority of the cases recover under medical treatment; they are in favour of early operation when interference is indicated, and consider that the question will usually be settled within the first forty-eight hours.

A very useful chapter is devoted to the various methods employed of removing the appendix during the quiet period. The authors themselves employ a nearly vertical incision over the outer edge of the rectus muscle and to the inner side of the semilunar line. The rectus sheath is opened, the muscle is drawn aside, and the abdomen is entered by dividing the posterior layer of the rectus sheath. The divided parts are united by buried sutures—after the appendix is removed—and the rectus allowed to drop back into place again. The appendix is removed by crushing it with a special clamp close to its origin from the cæcum. The clamp divides the mucous and muscular coats, leaving only the peritoneum. This stalk is ligatured with silk and is then sewn into the cæcum. Every surgeon has his own particular method, but the authors do not advance for their special procedure any convincing arguments which would demand the giving up of the very simple straightforward operation of excising the diseased organ. Clamps have played a part in the early stages of abdominal surgery, but they have been, one by one, abandoned.

The work deals with the very vexed question of removing the appendix after an abscess has been opened and treated. The authors state their case very temperately and with excellent judgment. The concluding chapters of the book deal in a very able manner with the manifold complications of appendix. The work is one which reflects great credit upon the writers, and which will prove of the utmost service to the surgeon who wishes to make himself acquainted with the surgery of this common ailment.

Frederick Treves.

"Clinical and Pathological Observations on Acute Abdominal Diseases." By Edred W. Corner, M.B., B.C., F.R.C.S. London: Constable and Co., 1904.

This little book of 98 pages, contains, as the Preface states, "the material collected for the Erasmus Wilson Lectures, delivered at the Royal College of Surgeons, March, 1904." It does not therefore profess

to present itself as a coherent whole. It deals most prominently with infective necrosis in acute abdominal cases. An analysis of the examples of "acute abdominal disease" admitted into St. Thomas's Hospital in three years gives the following results :—

Appendicitis	37 per cent.
Intestinal obstruction, including intussusception ..	39 ,,
Perforations	11 ,,
Gynæcological cases	6 ,,
Peritonitis, of unknown origin	2 ,,
The rest..	5 ,,

One of the most interesting chapters in the book is that devoted to embolism and thrombosis of the visceral vessels of the abdomen, which is based upon the material provided by 150 published cases.

The following is a summary of the chief points derived from a consideration of these cases :—

"I. Clinical Table.

"(1) Embolism is most common in men past middle life.

"(2) It is most common secondary to valvular disease of the heart, especially mitral disease.

"(3) The onset is generally sudden, with symptoms of peritonism.

"(4) In one case the picture is one of intestinal obstruction, peritonitis due to appendicitis, or the perforation of a gastric ulcer.

"(5) There is also another class in which blood is passed *per rectum*, and which signifies infarction of the bowel.

"(6) Subacute and chronic cases are seen as well as the most acute.

"(7) In some cases it is most probably spontaneously recoverable from, especially if only a small area of bowel is rendered bloodless.

"II. Pathological Table.

"(1) For a constant situation of the embolus in the superior mesenteric artery, as in the main trunk, all varieties of clinical cases have been reported, from the most acute and fulminating, to cases which recovered, apparently without symptoms.

"(2) With a precisely similar lesion some subjects die in thirty hours and some not for from twelve to twenty days.

"(3) Gangrene of the gut has been noticed to have occurred within thirty hours, and sometimes not after twenty-two days.

"(4) A collateral circulation can be formed in slowly developing cases of visceral vascular obstruction.

"(5) The superior mesenteric artery is almost invariably picked out for the site of the embolus in fatal cases.

"(6) The explanation of the individual variations seems to depend upon the pathogenicity of the bacteria present in the gut. On the bacteriology of this affection there is no work done."

The remainder of the book is made up of notes—more or less interesting—on such topics as appendicitis in hernia sacs, intestinal suturing, diseases of Meckel's diverticulum, acute pancreatitis and perforated gastric ulcer.

Frederick Treves.

Current Literature.

Syphilitic Aortitis.—Professor V. Düring, in a paper published in the *Deutsch. Med. Wochensch.*, December 15th, 1904, on syphilitic disease of the circulatory organs, deals mainly with syphilitic aortitis. He distinguishes two forms of syphilitic arteritis: (1) That described by Heubner, which leads to partial closure of the vessels; and (2) Doehle's mesarteritis (or better, syphilitic aortitis), which by its terminal cicatricial processes, entailing a diminished power of resistance of the vessel wall, is the most frequent cause of dilatation and aneurysm of the aorta.

The merit of having described a special form of aortitis, which is easily separable from chronic endarteritis, with which it was previously mixed up, and thus showing the connection, assumed by clinical observers, between this form of syphilitic disease of the aorta and aneurysm and heart disease, belongs to the Pathological Institute of Kiel. Doehle, in 1885, and again in 1894, described so well the histological changes, the naked-eye appearances, and the occurrence of aneurysm as a result of the changes in the walls of the aorta that nothing remains to be added to-day. Heller also reviewed the subject at the meeting of the German Pathological Society in 1899; but their views did not meet with general acceptance until after the meeting of the Cassel Naturalists' Society, in 1903, before which Chiari read a paper adopting essentially the whole of Doehle and Heller's views.

In the description of syphilitis aortitis V. Düring states that the changes are almost exclusively confined to the thoracic aorta. Its interior, especially in the ascending portion, and frequently most markedly over the aortic valves, presents an irregular plicated surface; the tunica intima is often thickened in places, and between them are numerous shallow pits and sharply circumscribed hollows in which the arterial wall is thinned and translucent; Doehle compares these little cavities very appropriately to punched-out depressions. The intima surrounding these little pits is folded, puckered, and drawn into them. The thickened parts of the intima are not arranged in plaques or spots of any size but are more diffuse, and have a tendency to contraction and puckering. They may often be entirely absent, and even when they are developed to a considerable extent, they do not obliterate the characteristic appearances. Even with the naked eye it can be seen that the essence of the whole process is not in the intima, but must lie in the adjoining coats, the fundamental difference between it and endarteritis deformans. This peculiar condition of the intima, the puckering, pitting and furrowing, the peculiar localisation in the ascending aorta, the aortic arch, and descending thoracic aorta, with almost entire absence of a tendency to retrograde metamorphosis in the thickenings of the intima, are the points by which this form of aortitis is distinguished microscopically by Chiari from endarteritis deformans.

The outcome of the whole process and its essential significance for further consequences lie in the retracted transparent parts, which mark a thinning of the walls. The microscopic appearances vary according to

the stage which the aortitis has reached. In recent cases the most striking of these are foci of inflammation in the middle coat. Rather extensive, diffused, or localised deposits consisting partly of round cells, partly of granulation tissue, and partly of young connective tissue are found in the media. These infiltrates run from the tunica adventitia to the inner coat; they are frequently arranged round newly formed vessels, and they push aside and conceal the tissues of the middle coat; they not seldom contain giant cells. The focal infiltrations show here and there a tendency to necrotic decay, but more frequently even here the tendency peculiar to the whole process is to transformation into connective and cicatricial tissue. Not seldom we find considerable parts of the middle coat necrotic, and either embedded in somewhat massive foci of inflammation or almost without signs of inflammation.

The tunica adventitia presents similar signs of inflammation, which are here, however, more associated with the vasa vasorum, although not exclusively. We see here inflammation around the vessels—periarteritis—but also processes which lead to the obliteration of the vessels.

On the other hand, pronounced vascular proliferation is shown, the new formation of vessels ensheathed in inflammatory products which extend into the middle coat or often as far as the inner coat. The condition of the latter varies; while it may often be normal, it appears in other cases to be secondarily involved and thickened. At the point where organisation of the infiltrates into the middle coat begins the intima is retracted, it becomes involved in the scar tissue; we might almost speak of microscopic aneurysms.

In contradistinction to endarteritis deformans, retrogressive metamorphosis—fatty degeneration, calcification, formation of atheromatous ulcers—do not occur in pure cases of syphilitic aortitis. Where they do occur they imply combination with endarteritis deformans. The typical distinction between the two processes is that in syphilitic aortitis, with absence or only a slight degree of involvement of the inner coat, disease of the middle coat occupies the most prominent place; whereas in endarteritis deformans, disease of the intima predominates with almost total absence of, or insignificant secondary, disease of the media.

In older cases there are, partly with and partly without the histological changes described, connective tissue scaring and consequent shrinking in place of the earlier infiltrates. In presence of considerable gummatous infiltrates and periarteritis, thickening of the walls may, of course, occur, but the formation of scars is typical of syphilitic aortitis; the wall of the vessel is thinned; it is composed solely of connective tissue—adventitia *plus* intima—with endothelial covering. Corresponding to this change are the furrows and depressions described under naked-eye appearances. In such specimens little or nothing is to be found of the middle coat; muscular fibres and elastic tissue have perished.

The destruction of the middle coat may be brought about in various ways. Either it is directly displaced and destroyed by diffuse interstitial or focal (gummatous, if you will) infiltrates, the latter then becoming organised and converted into scar tissue; or, in the case of the focal infiltrates, central necrosis occurs. Even then, for the most part, absorption and encapsulation with scar tissue of the necrotic focus probably occurs.

A third method has recently been pointed out by Doehle, which constitutes a process peculiar to this form of aortitis. This is the occurrence of necrosis in the middle coat without preliminary inflammation, naturally with the same ultimate outcome in scar tissue. In specimens of such cases one often sees large localised or diffused infiltrations in the tunica adventitia. Corresponding to the vessels surrounded by these infiltrations, or to vessels directly closed by obliterating endarteritis, considerable tracts of the middle coat are seen in the primary stage of necrosis, which finds its expression in the absence of nuclear staining. Subsequently this musculo-elastic sequestrum is surrounded by an infiltrate and ultimately encapsulated in scar tissue.

G. Coutts.

Schnabel, surgeon for skin diseases in Magdeburg, reports in the same number of the *Deutsch. Med. Wochensch.*, on the treatment of syphilis by mercurial injections.

He has found that injections of a 10 per cent. mercury salicylate and paraffin emulsion are sometimes followed by severe gastro-enteric symptoms three to six hours after an injection. The symptoms consist of very severe colicky attacks, frequent loose stools sometimes containing blood, vomiting, &c.

These attacks, he has found, can be obviated by the use of vasenolum liquidum prepared from vasenol, a special kind of vaseline manufactured by the firm of Dr. A. Kopp, of Leipsig. Thimm reports regarding this substance that in ordinary 10 per cent. concentration it forms with insoluble mercury salts an excellent, finely divided, non-granular, homogeneous suspension, sterilisable by heat, such as cannot be obtained with olive oil or paraffinum liquidum. With long standing the insoluble mercury salt does not fall to the bottom; all that happens is the formation on the surface of a thin oily layer, but slight shaking suffices to render the mixture homogeneous and fit for use.

Two disadvantages are, however, admitted in the use of this suspending medium. In the first place painful infiltrations into the gluteal region occur much more regularly and last much longer than one is accustomed to see with paraffin emulsions. Secondly, it is more difficult to get rid of air accidentally drawn up into the syringe; and it also happens that minute air bubbles are to be found in the interior of the vasenol mass, which cannot be seen through the opaque material.

G. Coutts.

A Portable Isolation Chamber for Use in Hot Climates.—Dr. Marchoux, of the Pasteur Institute at Rio-de-Janeiro, has devised a portable framework (*Le Caducée*, December 3rd, 1904), whereby a patient can be isolated and protected from noxious insects. The "cage" is 3 metres in length and the same in width; and 2½ in height. It is made of a solid framework of iron, over which is stretched wire gauze, with meshes of half a mm. The chamber is closed by a lobby 80 cm. deep, having two doors, one opening inwards, and the other outwards. A system of weights prevents both doors from being open simultaneously.

These cages are large enough to contain a bed and a table, and to allow persons to pass around the patient. As they are made of separate panels, their size varies as required. Whatever this may be, they effectually exclude insects, but they provide for sufficient ventilation.

They are far superior to wire-work doors and windows. If a mosquito should by accident get inside, the insect can be easily caught and destroyed.

There is another advantage connected with these portable chambers. Any hospital and even a simple barrack-room can be easily converted into a model isolation hospital. By means of a simple curtain, patients may be shut off from each other; and visitors can talk to patients without coming too close to them. Other advantages will probably be found connected with them.

T. P. Smith.

Treatment of Ulcers of Hot Climates.—M. Regnault, a naval surgeon (*Arch. gen. de méd.*, September, 1904, and *Le Caducée*, November 5th, 1904), strongly recommends the application of a solution of hydrate of chloral, as fulfilling the following indications: it does not cause pain, but has an opposite effect; it has decided and continuous antiseptic properties; it stimulates granulation, and lessens congestion of the margins of the ulcers.

Ulcers of the first degree are dressed with a solution of chloral. Those of the second are washed and cleansed with a 2 per cent. lukewarm solution, and then covered with pledgets of cotton-wool saturated therewith and pressed. Over these is placed gutta-percha tissue or impermeable linen, fenestrated in proportion to the degree of inflammation of the margin of the ulcer, and the rapidity of evaporation desired. This dressing is retained by bands of gauze and allowed to remain from two to four days. The treatment is continued until healthy granulations are visible.

In dealing with ulcers of the third degree, the chloral solution is applied for from twelve to twenty-four hours. The ulcer is then bathed with two or three cc. of a 20 per cent. solution of cocaine for about a quarter-of-an-hour, in order to produce analgesia of the margins. Removal of the stiffened exudation and false membrane, which form the base of the ulcer, is effected by means of a kind of curette, composed of a crystal of sulphate of copper with sharp edges, and mounted upon a split rod of wood or bamboo. The latter should first be sterilised by heat or otherwise, and the caustic is fixed in position with thread. With this little contrivance, both mechanical and chemical effects are produced. The subsequent treatment is that of ulcers of the second degree; but cicatrisation is of course a more tedious process.

T. P. Smith.

The Resistance of the Plague Bacillus, its Presence in the Blood of Patients, and the Part Played by Fleas.—A few remarks on these subjects by M. Uriarte, Director of the Epidemiological Laboratory at Buenos Ayres, are published in *Le Caducée*, October 1st, 1904. He had been furnished with seventeen cultures of the plague bacillus made in October, November and December, 1899. These had been left untouched, and the object was to estimate the duration of the vitality and the virulence of the microbe. These cultures were used February 28th, 1904, and gave fourteen positive results. Six of them taken up on a loop of platinum wire and diluted with 1 cc. of broth were inoculated in the peritoneal cavities of guinea-pigs; the animals died at intervals varying

from sixteen hours to fourteen days. As regards the presence of bacilli in the blood of patients, they would seem to exist more frequently than is generally supposed in comparatively mild cases, with simple buboes, non-septicæmic. Four experiments made with 30 drops of blood added to 300 cc. of broth gave positive results.

Attempts were made to discover whether fleas of the rat could bite human beings. Of the insects found on rodents (*Mus decumanus*) caught near a plague focus, eighty-two belonged to the species *P. irritans*, and four to *P. serraticeps*. Men were bitten by some of both kinds, even when the insects were not fasting. The determination of the species showed us that fleas found on rats do not always belong to the species that usually occur on these rodents. Further experiments, like others previously published, show that fleas of the species *irritans*, caught on rats suffering from plague, by simply passing over the surface of jelly, cause the appearance of many colonies of the microbes, which are also to be found in the intestines of the insects.

T. P. Smith.

Notes on the Employment of Supra-renal Capsule Extracts for Producing Local Analgesia.—In the *D. Militärärztliche Zeitschrift*, November, 1904, Assistant-Surgeon Salecker gives his experience of this method. After alluding to the discovery by Brown-Sequard, of the fatal results of removal of these bodies, and by other observers of the power of the extract, given internally, to increase blood pressure, he goes on to describe Braun's method of producing local anæsthesia, first made known in the beginning of 1903. This plan has been tried, and for the most part with success, by Salecker in about ninety cases, including whitlows, suppuration of the matrix of a nail, phlegmons, boils, abscesses, carbuncles, glandular suppuration, dental caries, the removal of small tumours (atheroma, pointed condylomata and fibroma), phimosis and various injuries. The requisite instruments are very simple; only a Pravaz syringe, with a cannula two inches long. Two solutions are used; one containing adrenalin, the other eucaine. The former is composed as follows: adrenal hydrochlorid. 0·1; sodii chlorid. 0·7; chloretone 0·5; aq. dest. 100·0. For the second, eucain. B. 0·2; sodii chlorid. 0·15, aq. dest. 20·0. Eucaine is preferable to cocaine as being far less dangerous, much cheaper, and retaining its properties on boiling. It is also quite as efficacious.

Before being used, each solution is to be boiled, and then allowed to cool down to the body temperature. One measure of the adrenalin solution is then drawn into the syringe, which is filled up with the eucaine solution. The mixture therefore contains 0·1 mg. of adrenalin. In dealing with a case of subungual suppuration of the right forefinger, the needle of the syringe is inserted between the second and third phalanges, first on the dorsal and then on the palmar surface, half its contents used on each. In half a minute the top of the finger appears bloodless. In five minutes the nail is divided, and each half removed with forceps. There is no pain, and only slight hæmorrhage. Carbuncles can be treated by injecting the fluid at four equidistant spots near the margin, the needle being directed towards the middle of the swelling. Anæmia is soon produced, and in ten minutes a crucial incision can be made and the necrosed tissue removed without causing any pain. Some hæmorrhage may take place

from large veins. A mammary fibroma and suppurating cervical glands were similarly treated. Operations on the penis can be very successfully accomplished, without pain or hæmorrhage. The employment of the method in dental cases generally failed to prevent pain. There was no effect in dealing with the lower jaw; and only in one case a premolar was removed from the upper jaw without pain. But the insertion of the needle and the injection were very painful. Previous to performing minor operations on the limbs, injections along the course of nerves supplying the part answered very satisfactorily. Absolute analgesia could often be produced, and unpleasant consequences were very rare.

T. P. Smith.

Paludism in Madagascar.—M. Laveran has pointed out to the Academy of Medicine that two factors play an important part in the production of paludism in Madagascar (*Le Caducée*, December 3rd, 1904). The first is the frequency of malarial disease among all young native children, who become an important source of infection. Their blood frequently contains hæmatozoa, while symptoms of the disease are often but slightly marked, and they take quinine with difficulty. The second important factor is the change in the method of rice culture; the natives have abandoned the use of running water, and substituted stagnant swamps, in which, after harvest, they allow vegetable stalks to rot, with the idea of obtaining a kind of manure. But in such swamps, *Anopheles* increase and multiply; and paludism, formerly rare in some districts, has now become very common.

In conclusion, Laveran recommends that the rice culture should be regulated, that the fields should be allowed to dry after harvest, and that running water should replace the stagnant swamps. Dwelling houses should be at least two kilometres distant from rice-fields. The workpeople ought to be protected at night against *Anopheles* by the ordinary measures, wire gauze, veils and gloves; and quinine should be given as a prophylactic.

T. P. Smith.

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Corps News.

February, 1905.

Army Medical Staff.

Surgeon-General Sir W. Taylor, M.D., K.C.B., K.H.P., is placed on retired pay, dated December 2, 1904. He entered the Service, September 30, 1864; was promoted Surgeon, March 1, 1873; Surgeon-Major, September 30, 1876; Brigade-Surgeon-Lieutenant-Colonel, February 5, 1890; Surgeon-Colonel, March 10, 1895; Surgeon-Major-General, March 25, 1896; and was appointed Director-General, December 2, 1901. His war services are as follows: Jowaki Expedition, 1877. Medal. Burmese Expedition, 1885-6. Served on the Staff of the Commander-in-Chief in India. Despatches, *London Gazette*, September 2, 1887. Clasp. Hazara Expedition, 1888. Burmese Expedition, 1888-9. Japan and China War, 1894-5.—Attached to Head Quarters Japanese Army. Japanese war medal. Ashanti Expedition, 1895-6, as Principal Medical Officer. Honourably mentioned. Promoted Surgeon-Major-General. Star. Nile Expedition, 1898, as Principal Medical Officer. Battle of Khartoum. Despatches, *London Gazette*, September 30, 1898. C.B. 2nd class of the Medjidie. Egyptian medal with clasp. Medal.

Sir W. Taylor filled the post of Deputy Director-General previously to proceeding to India as Principal Medical Officer, Her Majesty's Forces, in 1899, where he remained until he returned to take up the appointment of Director-General, Army Medical Service. Sir William, who was a Knight of Grace of the Order of St. John of Jerusalem in England, was granted a Good Service Reward on October 1, 1899; was appointed Honorary Physician to the King, August 21, 1901; and promoted K.C.B., June 26, 1902.

Army Medical Staff.

Colonel W. Donovan, C.B., from Royal Army Medical Corps, to be Surgeon-General, vice Sir W. Taylor, M.B., K.C.B., K.H.P., dated December 2, 1904.

Colonel (temporary Surgeon-General) A. Keogh, M.D., C.B., from Royal Army Medical Corps, to be Surgeon-General, to complete establishment, dated December 3, 1904.

Army Medical Service.

Surgeon-General A. Keogh, M.D., C.B., is appointed Director-General, vice Sir W. Taylor, M.D., K.C.B., K.H.P., retired, dated January 1, 1905.

Royal Army Medical Corps.

Lieutenant-Colonel J. R. Mallins, M.B., retires on retired pay, dated December 14, 1904. He entered the Service, August 2, 1884; was promoted Surgeon-Major, August 2, 1896; and Lieut.-Colonel, August 2, 1904. His war services are as follows: Soudan, 1885-6. Frontier Field Force. Medal, bronze star. South African War, 1899-1902. Operations in Natal, 1899. Relief of Ladysmith, including action at Colenso; Operations of January 17 to 24, 1900, and action at Spion Kop. Operations in the Transvaal during periods in 1901-2. Despatches, *London Gazette*, February 8, 1901, and July 29, 1902. Queen's medal with three clasps. King's medal with two clasps.

Lieutenant F. H. Noke is confirmed in his rank.

The retirement of Major A. E. C. Spence, M.B., to take effect from November 21, 1904, and not as stated in the *London Gazette* of November 15, 1904.

Lieutenant F. M. G. Tulloch is seconded for service under the Foreign Office. Dated December 1, 1904.

Lieutenant-Colonel (temporary Surgeon-General) A. Keogh, M.D., C.B., to be Colonel, vice W. Donovan, C.B., promoted. Dated December 2, 1904.

Lieutenant-Colonel J. I. Routh to be Colonel, vice A. Keogh, M.D., C.B., promoted. Dated December 3, 1904.

Colonel A. H. Anthonisz, M.B., is placed on retired pay. Dated December 22, 1904. He entered the Service, April 1, 1871; was promoted Surgeon, March 1, 1873; Surgeon-Major, April 1, 1883; Surgeon-Lieutenant-Colonel, April 1, 1891; Brigade-Surgeon-Lieutenant-Colonel, May 15, 1895; and Colonel, November 15, 1899. His war services are as follows: Egyptian Expedition, 1882. Medal, bronze star. Soudan Expedition, 1885. Suakin. Clasp. South African War, 1899-1900. Queen's medal with clasp.

Surgeon-Lieutenant-Colonel J. Magill, M.D., C.B., from the Coldstream Guards, to be Lieutenant-Colonel, vice J. I. Routh, promoted, with seniority next above P. H. Johnston, M.D., C.M.G., dated December 3, 1904.

Captain W. J. P. Adye-Curran is placed on temporary half-pay on account of ill-health, dated December 23, 1904.

Captain A. J. M. Cudden-Fletcher resigns his commission, dated January 11, 1905.

Lieutenant L. Cotterill to be Captain (provisionally), dated December 5, 1904.

Captain C. J. O'Gorman, D.S.O., from the Seconded List, to be Captain, dated January 1, 1905.

Captain P. G. Stock resigns his commission, dated January 14, 1905. He entered the Service, April 25, 1900, and was promoted Captain, April 25, 1903. His war services are as follows: South African War, 1900-02. Operations in the Transvaal, November 30, 1900, to May, 1901. Queen's medal with three clasps; King's medal with two clasps.

Lieutenant M. F. Grant has obtained the degree of Master of Arts, University of Cambridge.

MEMORANDUM.

Colonel (temporary Surgeon-General) William Flack Stevenson, M.B., C.B., Royal Army Medical Corps, Professor of Clinical and Military Surgery, Royal Army Medical College, to be an Honorary Surgeon to the King, vice Surgeon-General J. Jameson, M.D., C.B., retired pay, deceased, dated September 14, 1904.

ARMY MEDICAL RESERVE OF OFFICERS.

Captain H. W. Thomson, M.D., Glasgow Companies Royal Army Medical Corps (Volunteers), to be Surgeon-Captain, dated December 24, 1904.

Surgeon-Lieutenant J. Bruce, M.B., to be Surgeon-Captain, dated November 16, 1904.

Surgeon-Lieutenant T. Beard to be Surgeon-Captain, dated December 21, 1904.

ROYAL ARMY MEDICAL CORPS (MILITIA).

Belfast District Company.—Lieutenant (Honorary Lieutenant in the Army) S. T. Beggs to be Captain, dated December 19, 1904.

ROYAL ARMY MEDICAL CORPS (VOLUNTEERS).

The Manchester Companies.—Harold Thompson, Gent., to be Quartermaster, dated December 24, 1904.

The Woolwich Companies.—Lieutenant-Colonel F. L. Stephenson, M.B., is granted the honorary rank of Colonel, dated December 24, 1904.

The London Companies.—Captain A. Granville is seconded whilst holding a civil appointment under the Egyptian Government, dated November 28, 1904.

Surgeon-Captain E. A. Snape, M.D., from the 2nd Middlesex Royal Garrison Artillery (Volunteers), to be Captain, dated January 4, 1905.

The Manchester Companies.—Gordon William Fitzgerald, Gent., to be Lieutenant, dated January 4, 1905.

The undermentioned Lieutenants to be Captains: H. G. Parker, dated January 7, 1905; W. R. N. Smithard, M.B., dated January 7, 1905; C. W. S. Saberton, M.B., dated January 7, 1905.

Cadet Corps (St. Michael's), Woolwich, attached to the Woolwich Companies.—Quartermaster J. P. Ekins, the Woolwich Companies, Royal Army Medical Corps (Volunteers), to be Captain, dated January 14, 1905.

Quartermaster A. J. Naylor, The Woolwich Companies Royal Army Medical Corps (Volunteers), to be Lieutenant, dated January 14, 1905.

Bearer Companies.

Sherwood Foresters.—Captain H. B. Job resigns his Commission, dated December 24, 1904.

Volunteer Corps.

The Highland Royal Garrison Artillery (Volunteers).—Surgeon-Lieutenant C. G. Mackay, M.B., resigns his Commission, with permission to retain his rank and to wear the prescribed uniform, dated December 24, 1904.

1st Lanarkshire Royal Garrison Artillery (Volunteers).—Surgeon-Lieutenant R. W. Forrest, M.B., to be Surgeon-Captain, dated December 24, 1904.

1st Aberdeenshire Royal Engineers (Volunteers).—Surgeon-Major J. J. Y. Dalgarno, M.B., resigns his Commission, with permission to retain his rank and to wear the prescribed uniform, dated December 24, 1904.

1st Cheshire Royal Engineers (Volunteers).—Harry George Frederick Dawson, Gent., to be Surgeon-Lieutenant, dated December 24, 1904.

1st Lancashire Royal Engineers (Volunteers).—Surgeon-Captain G. A. Hawkins-Ambler resigns his Commission, dated December 24, 1904.

2nd Volunteer Battalion the Cameronians (Scottish Rifles).—Surgeon-Lieutenant J. Marshall, M.B., to be Surgeon-Captain, dated December 24, 1904.

2nd Volunteer Battalion the Welsh Regiment.—The undermentioned Surgeon-Lieutenants resign their Commissions: W. F. Brook, dated December 24, 1904; T. M. J. Powell, M.B, dated December 24, 1904.

1st (City of Dundee) Volunteer Battalion the Black Watch (Royal Highlanders).—Captain G. W. Miller resigns his Commission, and is appointed Surgeon-Lieutenant, dated December 24, 1904.

6th Volunteer Battalion the Manchester Regiment.—The undermentioned Surgeon-Lieutenant-Colonels are granted the honorary rank of Surgeon-Colonel: T. Fort, dated December 24, 1904; R. L. Sparrow, dated December 24, 1904.

2nd Volunteer Battalion the Prince of Wales's (North Staffordshire Regiment).—Ambrose Henry Palmer, Gent., to be Surgeon-Lieutenant, dated December 24, 1904.

1st Gloucestershire Royal Garrison Artillery (Volunteers).—Surgeon-Lieutenant-Colonel D. S. Davies, M.D., resigns his Commission, with permission to retain his rank and to wear the prescribed uniform, dated January 4, 1905.

2nd Sussex Royal Garrison Artillery (Volunteers).—Surgeon-Major H. Habgood, M.D., to be Surgeon-Lieutenant-Colonel, dated January 4, 1905.

The Cambridge University.—Surgeon-Lieutenant H. B. Roderick, M.D., to be Surgeon-Captain, dated January 4, 1905.

1st Bucks.—Supernumerary Surgeon-Major (Brigade-Surgeon-Lieutenant-Colonel) W. H. Bull (Senior Medical Officer, Home Counties Volunteer Infantry Brigade) to be Surgeon-Lieutenant-Colonel, and to remain seconded, dated January 4, 1905.

1st Sutherland (The Sutherland Highland).—Surgeon-Lieutenant S. Elliot, M.B., resigns his Commission, dated January 4, 1905.

7th Middlesex (London Scottish).—Surgeon-Lieutenant-Colonel J. Cantlie, M.B., resigns his Commission, and is granted the honorary rank of Surgeon-Colonel, with permission to wear the prescribed uniform, dated January 4, 1905.

1st Fifeshire Royal Garrison Artillery (Volunteers).—Supernumerary Surgeon-Major (Honorary Captain in the Army) S. Linton, M.B., resigns his Commission, with permission to retain his rank and to wear the prescribed uniform, dated January 7, 1905.

2nd East Riding of Yorkshire Royal Garrison Artillery (Volunteers).—Surgeon-Lieutenant A. W. Scott to be Surgeon-Captain, dated January 7, 1905.

4th Volunteer Battalion the Royal Fusiliers (City of London Regiment).—Supernumerary Brigade-Surgeon-Lieutenant-Colonel W. B. Waterhouse (Senior Medical Officer, 2nd London Volunteer Infantry Brigade) is granted the honorary rank of Surgeon-Colonel, dated January 7, 1905.

5th Volunteer Battalion the Royal Scots (Lothian Regiment).—Surgeon-Captain T. Wood, M.B., resigns his Commission, dated January 14, 1905.

2nd Volunteer Battalion the Worcestershire Regiment. — Hubert Rodney Ross Fowler, Gent., to be Surgeon-Lieutenant, dated January 14, 1905.

2nd (Angus) Volunteer Battalion the Black Watch (Royal Highlanders). — Surgeon-Lieutenant-Colonel R. Grant resigns his Commission, and is granted the honorary rank of Surgeon-Colonel, with permission to wear the prescribed uniform, dated January 14, 1905.

3rd (Dundee Highland) Volunteer Battalion the Black Watch (Royal Highlanders).—Edward Fox McLeod Neave, M.D., to be Surgeon-Lieutenant, dated January 14, 1905.

2nd Volunteer Battalion the Sherwood Foresters (Nottinghamshire and Derbyshire Regiment).—The undermentioned Surgeon-Lieutenants to be Surgeon-Captains: H. Allan, dated January 14, 1905; J. H. Maclean, dated January 14, 1905.

ARRIVALS HOME.—From India: Colonel J. M. Beamish (on leave pending retirement); Majors C. A. Stone and J. S. Davidson; Captains C. W. Mainprise and O. W. A. Elsner. From South Africa: Captain M. H. G. Fell. From Gibraltar: Lieutenant-Colonel A. Dodd (by exchange), and Major F. J. Wade-Brown. From Malta: Captain F. Harvey. From Mauritius: Captain H. F. Shea. From West Africa: Captains A. C. Fox and E. F. Q. L'Estrange.

ARRIVALS HOME ON LEAVE.—From India: Lieutenant-Colonel A. E. Tate and Lieutenant J. C. G. Carmichael. From South Africa: Captain C. S. Cato.

EMBARKATIONS.—For India: Major H. A. Haines; Captain J. B. Anderson; Lieutenants J. D. Richmond, J. E. Powell, and H. Harding. For South Africa: Lieutenant-Colonels W. J. Macnamara, W. Heffernan and T. E. Noding; Major M. O'Halloran; Captain J. R. McMunn; Lieutenants D. Le Bas, E. M. Glanvill, J. T. McEntire, G. S. Mackay, and E. H. M. Moore.

POSTINGS. — Lieutenant-Colonel R. H. Forman to Woolwich. Majors J. S. Davidson and F. J. Wade-Brown to Southern District. Major C. A. Stone to South-Eastern District. Captain P. S. Lelean to Aldershot. Captain H. F. Shea to Salisbury Plain. Captain C. G. Thomson to Ireland. Captain C. S. Cato to North-Western District. Captain M. H. G. Fell to Southern District.

CHANGES OF STATION.—Lieutenant-Colonel Sir A. A. Brooke-Pechell, Bt., from Ireland to Southern District; and Captain A. C. Lupton from Home District to North-Eastern District.

ROYAL ARMY MEDICAL CORPS.

LIST OF CASUALTIES, &c.—From December 11, 1904, to January 10, 1905, inclusive:—

Discharges.—5641 Staff-Sergeant T. Moody, second period, December 31; 5702 Lance-Sergeant C. W. Witherow, medically unfit, January 3; 9735 Private J. A. Snell, first period, December 17.

To Army Reserve.—11644 Private E. Mogford, December 16; 15722 Private G. F. Pinkney, December 17.

Transfers to other Corps.—8609 Staff-Sergeant G. Cookson to East Surrey Volunteer Battalion Bearer Company, December 19; 19212 Private J. Thompson to 8th Hussars, December 12; 19195 Private R. W. Manders to 8th Hussars, December 15; 19364 Private T. Smyth to 8th Hussars, December 19; 19339 Private H. Bell to 8th Hussars, December 23; 19269 Private J. W. Hattam to 8th Hussars, January 1; 19996 Private A. Biggs to King's Dragoon Guards, December 20; 19335 Private A. Spiers to Royal Welsh Fusiliers, December 19; 19243 Private W. E. Ryder to Royal Horse Artillery, December 23; 17832 Private A. J. Atkinson to Army Service Corps, January 1.

Embarkations.—To South Africa, per s.s. "Dunera," December 22: 8991 Staff-Sergeant R. Cox; 14505 Sergeant H. Jones; 10004 Sergeant G. Elliott; 12932 Sergeant C. Gordon; 11173 Sergeant C. J. Hazell; 10690 Sergeant P. Le Poidevin; 11059 Sergeant J. Dunn; 10296 Sergeant H. A. Bangert; 11111 Sergeant A. Senior; 10675 Sergeant W. Richardson.

To South Africa, per s.s. "Walmer Castle," December 24: 4835 Sergeant-Major C. Kinsella; Sergeant-Major W. H. Bellingham; 7810 Sergeant-Major T. Cronin; 10162 Staff-Sergeant C. Drury; 8086 Staff-Sergeant W. Gough; 8280 Staff-Sergeant E. E. Ward; 7692 Staff-Sergeant C. W. Beaumont; 7690 Staff-Sergeant W. H. Pleass, 9800; Staff-Sergeant W. C. Renton; 9515 Sergeant R. J. Fleming; 11144 Sergeant A. McCrarth: 12816 Sergeant D. J. Bell; 9134 Sergeant H. Ladwick; 9200 Sergeant T. J. Cross; 10953 Sergeant W. H. Way; 9205 Sergeant F. Judd; 9509 Sergeant G. Manship.

Disembarkations.—From South Africa, per s.s. "Avondale Castle," December 16: 9263 Staff-Sergeant W. Brennan; 9862 Sergeant W. F. Smith.

From Sierra Leone, per s.s. "Nigeria," December 28: 17872 Lance-Corporal C. Thorp.

From Northern Nigeria, December 29: 8726 Sergeant V. B. Griffiths.

Deaths.—10407 Sergeant J. Vickers at Malta, December 11, from enteric.

QUEEN ALEXANDRA'S IMPERIAL MILITARY NURSING SERVICE:—

Appointments.—To be Staff-Nurses: Miss E. M. Goard, Miss E. J. Minns.

Resignations.—The following ladies have resigned their appointments: Sisters: Miss E. Cox, Miss E. M. Monck-Mason, Miss D. F. Palmer.

Change of Station: Sister: Miss M. L. Harris, Woolwich to Chatham; Staff-Nurse: Miss P. Steele, Royal Military College, Sandhurst, to Chatham.

NOTES FROM THE BARBADOS COMMAND.—Lieutenant-Colonel F. P. Nichols, R.A.M.C., Officer Commanding Station Hospital, Barbados, writes: "There have been no changes of stations or alterations in appointments held by R.A.M.C. officers since my last monthly letter.

"Certificate of education has been awarded to the undermentioned man:—

"No. 18940 Private H. Cooper, 2nd class.

"The annual dinner of the Detachment R.A.M.C. took place on Christmas Day, and was a most successful event, the men's barrack-room being very artistically decorated for the occasion, and was admitted by all to be second to none in the garrison."

NOTES FROM THE CURRAGH.—Captain E. W. W. Cochrane, R.A.M.C., writes: "Captain J. R. McMunn left the station at the end of November, proceeding on leave prior to embarkation for South Africa.

"Major C. Dalton has gone on leave this month, and embarks for the Punjab early next year.

"Captain J. H. Brunskill is under orders for Madras in January next. Lieutenants Douglas, Otway and Ahern have also received orders for India, starting early next year.

"Major M. O'Halloran has left Newbridge *en route* for South Africa, and has been relieved by Captain J. Poe, on return from foreign service.

"Captain E. W. W. Cochrane has been appointed Company Officer of No. 17 Company R.A.M.C., vice Captain J. R. McMunn.

"A meeting of Medical Officers was held at the Station Hospital, Curragh, on December 16, 1904, when Major W. B. Day delivered an address on the treatment of hyperpyrexia, and as his views on the use of antipyretic drugs differed in many respects from those of the 'text-books,' there were several points which gave rise to discussion afterwards.

"The football team of No. 17 Company R.A.M.C. has played eight matches in the Curragh District League, and their present position is as follows: Matches played, 8; won 2; lost 4; drawn 2; points 6. Although this result is not as satisfactory as might be wished, it is pleasing to know that, though the smallest unit in camp, we are well removed from the bottom of the list. One of the matches won was against the 19th Hussars, who, at present, head the league. The team is strong in defence, but the attack is rather weak, and we have been unable to get satisfactory combination amongst the forwards, as, owing to injuries and transfers, the line of attack has been altered continually. Lieutenant Douglas, who played inside right, has been unable to turn out for some time past, owing to an injured knee. Private Mayo at back and Private Curry at centre-half have been the mainstay of the team."

NOTES FROM HONG KONG. — Lieutenant B. A. Craig, R.A.M.C., writes: "Lieutenant Ranking and Lieutenant and Quartermaster Wilson arrived by the Transport 'Dilwara,' with one Warrant and twenty-four N.C.O.'s and men to relieve the tour-expired Officers, N.C.O.'s and men of the detachment.

"Captain Parker and Lieutenant and Quartermaster McClay, with one Warrant and about seventeen N.C.O.'s and men (R.A.M.C.), go home in the Transport 'Dilwara' on the 21st inst.

"The Cricket Club is in a flourishing condition under the able leadership of Lieutenant Harvey. Up to date about twelve matches have been played, and there are fixtures up to the end of the season. Sergeant-Major Allwork and Sergeants Riordan

COMPASSIONATE FUND (General Relief).

Receipts.	£	s.	d.
Balance Credit from 1903	77	8	8
Nash Memorial	5	17	3
From late F.F. Canteen, South Africa	414	9	8
,, Aldershot Account	100	0	0
,, Lieutenant-Colonel Daly's Military Hospital Mineral Water Factory	423	15	3
,, Lieutenant-Colonel H. O. Trevor—Balance from Officers' Mess, Mandalay	1	10	0
,, Netley Canteen Fund	50	0	0
,, Regimental Cottage Homes	2	2	8
,, Major E. C. Freeman (contribution)	2	0	0
,, Lieutenant-Colonel W. A. Morris (contribution)	2	0	0
,, Regimental Institute, R.A.M.C., Middelburg, C.C., = £50 less 8s. 9d., Banker's charge	49	11	3
Remitted by the Misses Gordon	10	0	0
R.A.M.C. School of Instruction, Salisbury Plain, 1904	17	14	0
From Military Hospital, Kroonstad Canteen Fund	104	15	3
,, Lieutenant-Colonel Tyrrell—Balance of Fund for memorial to Lieutenant-Colonel Cree	4	4	0
Subscriptions from three Active List Officers	0	15	0
Interest on Deposit	11	13	10
	£1,277	16	10

Disbursements.				£	s.	d.
To Captain H. A. Hinge for General Relief				70	0	0
Officers' Endowment Fund, Corps of Commissionaires				10	0	0
National Association for Employment of Reserve and Discharged Soldiers				5	0	0
Incorporated Soldiers' and Sailors' Help Society for Princess Christian Home				161	1	8
Balance Credit (see Balance Sheet):—						
Deposit	£600	0	0			
Current Account	431	15	2			
				1,031	15	2
				£1,277	16	10

COMPASSIONATE FUND (Widows' and Orphans').

Receipts.	£	s.	d.
From late F.F. Canteen, South Africa	414	9	7
Interest on Deposit	7	15	10
	£422	5	5

Disbursements.				£	s.	d.
Balance Credit (see Balance Sheet):—						
Deposit	£400	0	0			
Current Account	22	5	5			
				422	5	5
				£422	5	5

BALANCE SHEET.

Assets.

	£	s.	d.	£	s.	d.	£	s.	d.
Cash at Banker's, Current Account.									
Balance from 1903	526	12	1						
Total Receipts as per Banker's Pass Book (including £42 19s. withdrawn from Deposit, Charitable Schools)	2,595	15	4						
				3,122	7	5			
Total Expenditure as per Banker's Pass Book	978	9	0						
Placed on Deposit	1,500	0	0						
				2,478	9	0			
							643	18	5
Deposit Account—									
Charitable Schools				1,348	0	2			
General Fund				1,500	0	0			
							2,848	0	2
Cash in hands of Honorary Secretary							2	0	8½
							£3,493	19	3½

Liabilities.

	£	s.	d.
To Memorial Fund	533	13	6½
,, Band Fund	72	6	10
,, Dinner Fund	48	5	8
,, Compassionate Fund (Charitable Schools)	1,385	12	8
,, ,, ,, (General Relief)	1,031	15	2
,, ,, ,, (Widows' and Orphans')	422	5	5
	£3,493	19	3½

Audit of Accounts of Royal Army Medical Corps Fund.

We have this day inspected the Accounts produced by the Honorary Secretary and Treasurer of the above Fund; verified the Balance Sheet, which shows a sum of £3,493 19s. 3½d. to the credit of the Fund; counted the Cash Balance in the hands of the Secretary and find it correct—£2 0s. 8½d; checked the vouchers and receipts and inspected the current account, and find them correct; inspected the cheque and bank books, and are satisfied that the Accounts are correct.

January 9, 1905.

(*Signed*) H. E. R. JAMES, *Colonel, R.A.M.C.*
R. H. FIRTH, *Colonel, R.A.M.C.*

and Dearsley will be a loss to the team, but we hope several good cricketers have come out with the new draft. Major Sparkes played for the first time this season againt H.M.S. 'Thetis,' and carried out his bat for 21, besides bowling most of the opposing team out.

"At the examination for promotion held in May and June, 1904, Major Sparkes passed in Military Law; and Lieutenants Harvey and Craig passed in Military Law and R.A.M.C. subjects for promotion to Captain.

"Colonel W. E. Webb, P.M.O., the outgoing President of the British Medical Association (Hong Kong Branch), has this year been elected Vice-President.

"On December 9 the annual Christmas tree for the children of the detachment was held. The tree was prettily decorated by Mrs. Webb, Mrs. Parker, Mrs. Lambelle and Major Josling, S.M.O., and was a great success, Private Burnett, R.A.M.C., giving an excellent Punch and Judy show, which was greatly appreciated by the youthful guests."

NOTES FROM NETLEY. — Lieutenant-Colonel G. Twiss, R.A.M.C., writes: "Captain J. Cowan arrived for duty on December 18, 1904, and Quartermaster and Hon. Lieutenant H. Spackman on January 13, 1905. The former has taken over command of No. 4 Company, and the latter Quartermaster Companies R.A.M.C.

"Captain D. Lawson will take over the duties of anæsthetist on the departure of Captain G. B. Crisp for the Royal Army Medical College.

"Surgeon-General Sir E. Townsend, K.C.B., C.M.G., presented the prizes to the Lieutenants on Probation, Indian Medical Service, at the conclusion of their course on December 30, and wished them success in their careers.

"The Christmas festivities of the Companies comprised the Christmas dinner on December 25, the Sergeants' 'At Home' on Boxing Day, and a Sergeants' Dance on January 2.

"The patients had a good Christmas tea, followed by a concert, on December 24, and Christmas fare for dinner on Christmas Day.

"The decorations in the wards were a triumph of skill and good taste."

NOTES FROM THE NORTHERN COMMAND, INDIA.—Captain E. T. F. Birrell, R.A.M.C., writes:—

"*Departures.*

"The following Officers have left for England, tour expired: Major B. F. Zimmermann on November 16, 1904; Captain P. McKessack on November 2, 1904; Captain A. Chopping on November 16, 1904.

"*Examinations.*

"Extract from Northern Command Orders, dated November 17, 1904:—

"'636 *Royal Army Medical Corps Examinations.*—The undermentioned officer passed the examination in subject h(i) (Appendix VII., King's Regulations) on the date specified: Lieutenant R. Storrs, October 29, 1904 (Ambala).'

"Extract from India Army Orders dated November 21, 1904:—

"'823 *Royal Army Medical Corps Examinations.*—At the Examination of Majors for promotion to Lieutenant-Colonel and of Lieutenants for promotion to Captain, held in India in October, 1904, the undermentioned officers passed in the subjects specified:—

"'Subjects (2), (3 and 4) and (5), Appendix VIII.—B, King's Regulations: Majors B. F. Zimmermann, J. J. Russell, E. G. Brown.

"'Subjects (h—ii.) and (h—iii.): Lieutenants H. W. Long, J. A. Balck, S. M. W. Meadows, W. D. C. Kelly.'"

NOTES FROM SHORNCLIFFE.—The examinations in Anatomy of the class that has been held during the last six months by Major E. C. Anderson, D.S.O., were concluded at the end of last month. The prizes were awarded as follows: 17989 Private J. E. Travers, 1st; 18427 Private P. Barber, 2nd; 11710 Private P. S. Marr, 3rd.

A most successful concert and variety entertainment was organised for the patients in hospital on the 4th inst., the Brigadier-General and other officers, and ladies of the garrison attending and assisting in the performance.

The Detachment football team has this year, for the first time, been able to carry out a regular programme, and though not very successful up to date, show good promise of turning out a useful team.

Trinity College, Dublin, conferred the degree of Doctor of Science on Major Ronald Ross, C.B., F.R.S., on December 20.

BIRTHS.

BENNETT.—On December 21, at Marringhurst, Marple, Cheshire, the wife of Captain W. Leslie Bennett, R.A.M.C., of a daughter.

SEWELL.—At Mian Mir, Punjab, on December 18, 1904, the wife of Captain E. P. Sewell, M.B., R.A.M.C., of a daughter.

SKINNER.—On Wednesday, January 11, 1905, at 20, Merton Hall Road, Wimbledon, the wife of Lieutenant-Colonel Bruce M. Skinner, of a daughter.

MARRIAGES

WARING—SCOONES.—On December 16 (by licence), Captain Anthony H. Waring, R.A.M.C., son of Henry R. Waring, of Palma-de-Mallorca, Spain, to Isabel Frank Fenella, widow of the late Offley Scoones, only daughter of the late Lieutenant-Colonel F. M. Salmond, Royal Scots Fusiliers, and grand-daughter of the late General H. G. Hart.

DEATHS.

SAINTER.—On January 3, at Chester Villa, Craig Ellachie, Banffshire, Honorary Brigade-Surgeon James Dow Sainter, F.R.C.S.Edin., late Surgeon-Major, retired, Army Medical Department, aged 69 years. He entered the Service, March 1, 1859; was promoted Surgeon, March 1, 1873; and Surgeon-Major, April 1, 1874. He retired February 13, 1880.

NOTICE TO SUBSCRIBERS.

OFFICERS are particularly requested to give timely notice of changes of station or changes of address, in order to ensure the posting of the JOURNAL to its correct destination.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, &c. He will also be glad to receive items of news and information regarding matters of interest to the Corps from the various garrisons, districts and commands at home and abroad. All these communications should be written upon one side of the paper only, they should by preference be type-written, but, if not, all proper names should be written in capital letters (or printed) to avoid mistakes, and be addressed to the Editor, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, 68, Victoria Street, London, S.W.

Letters regarding subscriptions, non-delivery of the JOURNAL, or change of address, should be sent to Major T. McCulloch, R.A.M.C., 68, Victoria Street, London, S.W.

Communications have been received from Lieutenant-Colonels C. E. Nichol, J. D. Reckitt, J. E. Nicholson (ret.), A. B. Cottell (ret.), B. Skinner, G. Coutts, F. J. Jencken; Majors C. Garner, W. Turner, F. Smith, M. P. Holt; Captains J. C. B. Statham, J. C. Rutherford, D. J. Collins, J. C. P. Perry, W. S. Harrison, J. C. Kennedy.

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The following periodicals have been received: *The Medical Record, The Medical News, New York Medical Journal, American Medicine, Gazette Med. de Paris, Archives de Medicine et de Pharmacie Militaires, Il Morgagni, Gazetta Medico-Italiana, The Medical Review, El Siglo Medico, Der Militärärzt, Deutsche Militärärztliche Zeitschrift, Anales de Sanidad Militar, Revue Med. de la Suisse Romande, La Medicina Militar Espanola, The Boston Medical and Surgical Journal, Annali di Med. Navale, Giornale del Regio Esercito, Le Caducée, The Hospital, The Ophthalmoscope, St. Thomas's Hospital Gazette, Bulletin de l'Acad. de Med. de Paris, Arch. Med. Belges, Voyenno Medisinskii, The Indian Medical Gazette, The Australasian Medical Gazette, Journal of the Association of Military Surgeons, U.S., Militärlagen ungwet af Militärlaegeforeningen,* i Kjobenharn, *The Veterinary Journal, The Practitioner, Public Health, Medical Review, Journal of Infectious Diseases, Chicago, The Army and Navy Gazette, The United Service Gazette, Journal of the Royal United Service Institution, The Johns Hopkins Press.*

We desire to remind members who paid their first year's subscription by cheque or postal order that the annual subscription is due on July 1, and it is very important that such should be promptly paid.

NOTICE.

The Corps News is now printed as an inset to the JOURNAL and separate copies may be subscribed for, price 2d. monthly.

VOLUME IV. MARCH, 1905. No. 3.

Journal

of the

Royal Army Medical Corps.

Original Communications.

THE PROGRESS IN HYGIENE AND PREVENTIVE MEDICINE DURING 1904.

By LIEUTENANT-COLONEL R. H. FIRTH.
Royal Army Medical Corps.

ALTHOUGH the past year has not been characterised by any very startling discoveries or developments in preventive medicine, still a retrospect of what has been done shows that it has not been altogether barren of good work and, in some fields, of material progress. The more important facts which appear to me to be worthy of special notice, are the following:—

(1) SANITARY LEGISLATION.

To those of us who are familiar with the tangle of statutes which constitutes the Public Health Law of this country, it was a dominant hope that the year which has just ended would have seen the passing of an Act by which the law on this important matter would have been brought up to date and consolidated. This hope has not been fulfilled. Of the thirty-six Public General Acts of the session, only one, strictly speaking, is related exclusively to public health; but there are several others, related directly or indirectly to poor law administration, which have sufficient sanitary interest to merit brief reference.

Public Health Act, 1904.—Apart from its short title, this Act consists of one section. Its purport is to enable regulations to be

made for carrying into effect conventions with respect to the prevention of danger to public health from ships, and the prevention of the conveyance of disease or infection by means of vessels. The existing law contained ample provisions for making regulations for the protection of this country against the introduction of infection from abroad by shipping, but the Local Government Board, who control these matters, had no statutory powers to make regulations of the same nature for enforcement in the case of vessels leaving this country. The Paris International Convention of 1903, however, assumed that such regulations would be made and enforced ; it consequently became necessary to obtain from Parliament definite power to make them before the Convention could be signed for England. Hence the passing of this Act.

Army (*Annual*) *Act*.—Section 8 of this Act amends Section 145 (2) of the Army Act, 1881, in that it doubles the amounts which can be compulsorily stopped from the pay of a non-commissioned officer not under the rank of a sergeant, or of any other soldier, for the maintenance of his wife or legitimate children by Boards of Guardians and others. In the case of the former a sum not exceeding one shilling, and in the latter case a sum not exceeding sixpence, may be deducted from the daily pay.

Expiring Laws Continuance Act.—Among the various Acts whose operation is continued by this enactment is the Vaccination Act, 1898, which in place of expiring on December 31st, 1904, is now continued for another year.

Shop Hours Act.—This adds some fresh functions to local sanitary authorities, whereby they may make an Order, subject to confirmation by the central authority, as provided in the Act, for fixing the hours on the several days in the week at which, either throughout all the local area or in any specified part thereof, all shops of any specified class are to be closed for serving customers. The hour fixed by such an Order shall not be earlier than seven o'clock in the evening on any day of the week, except that on one specified day in the week it may be an hour not earlier than one o'clock in the afternoon. Power is given for the exception of certain trades or businesses.

Outdoor Relief (*Friendly Societies*) *Act*.—In estimating the amount of relief to be given to a person, being a member of a Friendly Society, this Act limits the discretion, previously vested in Boards of Guardians under the Act of 1894, to take into consideration the money which may be received from such Society. By the new Act, the Board of Guardians shall not take into consideration any sum received from a Friendly Society, as sick pay, except in so far as such sum shall exceed five shillings a week.

Prevention of Cruelty to Children Act.—While repealing the corresponding Act of 1894 and Sections 4 and 11 of the Employment of Children Act, 1903, it practically re-enacts the Bill of 1894. It does not impose upon Boards of Guardians the duty of instituting proceedings against those who assault, ill-treat, neglect or abandon, or expose to the detriment of their health, persons under the age of 16, but contemplates that they will do so when the circumstances are such as render it desirable in the public interest, and, moreover, empowers them to pay the costs and expenses out of public funds. Section 26 of the new Act also permits the Guardians of the Poor, with consent of Local Government Board, to subscribe to any Society or Association for the Prevention of Cruelty to Children.

Tuberculosis (Animals) Compensation Bill.—This Bill, providing for the payment of compensation to the owners of carcases of animals condemned after slaughter and destroyed by order of a magistrate on account of tuberculosis, did not pass; but, arising out of recommendations and report made by a Select Committee, to which the Bill had been referred, the Local Government Board issued an important circular to all sanitary authorities which, by virtue of the source from which it emanates, is equivalent practically to a legislative enactment. The more important parts of the circular are as follows: With regard to the variety of practices alleged to exist as to the amount of tubercular deposit, the existence of which in a carcase is held to justify its total condemnation, it appears to the Board to be most desirable that there should be uniformity in the practice of Meat Inspectors in dealing with the carcases of cattle, and they are of opinion that the following principles should be observed in the inspection of tuberculous carcases of cattle. The entire carcase and all the organs may be seized: (*a*) when there is miliary tuberculosis of both lungs; (*b*) when tuberculous lesions are present on the pleura and peritoneum; (*c*) when tuberculous lesions are present in the muscular system or in the lymphatic glands embedded in or between the muscles; (*d*) when tuberculous lesions exist in any part of an emaciated carcase. The entire carcase, if otherwise healthy, shall not be condemned, but every part of it containing tuberculous lesions shall be seized: (*a*) when the lesions are confined to the lungs and the thoracic lymphatic glands; (*b*) when the lesions are confined to the liver; (*c*) when the lesions are confined to the pharyngeal lymphatic glands; (*d*) when the lesions are confined to any combination of the foregoing, but are collectively small in extent. These practically are

the recommendations of the Royal Commission on Tuberculosis in their Report of 1898. As to complaints made by butchers regarding the injury caused to them by their prosecution in open Court for having tuberculous meat upon their premises, the Board reiterate the view of the Select Committee that, if a butcher who is in possession of tuberculous meat has notified the fact to the proper authority as soon as he could be reasonably expected to be aware of it, the case should not be taken into Court.

(2)—Special Matters of Interest.

Small-pox and Vaccinia.—For many years there has been a constant reference to the presence of protozoa in vaccinia and variola; so much has this been the case that the literature upon the subject is now fairly large. The first reference was contained in an article by Grünhager, published in 1872 (*Arch. f. Derm. u. Syph.*, S. 150); then followed a paper by Van der Loeff in 1887, and L. Pfeiffer's publications between 1887 and 1896. These early papers threw little or no light on the subject, and it was not till the appearance of Guarnieri's work in 1892 that progress can be recognised. In a previous annual summary I alluded to this work of Guarnieri (*Army Medical Department Report*, xliii., App. 1, p. 355), in which he described bodies, staining with carmine and other dyes, in the deep epithelial cells of the skin in vaccine and variola pustules, as well as in the epithelial cells of the cornea of rabbits which were inoculated either with variola virus or with vaccine. He thought he could recognise both nucleus and protoplasm in them and gave to them the name of "cytoryctes variolæ." His description of these bodies was very clear, and similar structures had been noted in like tissues by both Weigert and Renault. Since Guarnieri's first paper appeared a large number of articles have been published on the same subject, in the main confirmatory of his descriptions and interpretation of facts. The more important of these later papers are those by Guarnieri himself in 1894 and 1897, that by Monti (*Centr. f. Bakt.*, xvi., 1894), those by Clark in 1894 and 1895 (*Brit. Med. Journ.*, 1894, ii., p. 869, also *Centr. f. Bakt.*, xvii., 1895), and those by Wasielewski (*Zeitsch. f. Hyg.*, xxx., Hft. 8, and xxxviii., Hft. 5, 1901), and Gorini (*Centr. f. Bakt.*, xxix., 1901). Wasielewski's work in particular was valuable, as it first clearly showed the transmissibility of these bodies and their presumably specific nature. Since Guarnieri first gave a name to his so-called vaccine bodies, different views have been held as to

their exact nature; some observers, notably Hückel (*Beiträge z. Patholog. Anatom.*, xxv., 1898), while admitting their specific nature, regarded them as mere degenerations of the cell. Later work shows that Guarnieri's vaccine body, or cytoryctes variolæ, is to be found not only in vaccinia but also in variola, as one stage of the life cycle of a definite sporozoon. Further, it is certain that a second and more important cycle takes place within the nuclei of the generative cells of the skin and includes all the processes of reproduction. For the discovery of this phase we are indebted to Councilman, Magrath and Brinckerhoff (*Journ. Med. Res.*, ix., p. 372); while to Calkin (*Journ. Med. Res.*, xi., p. 136) we owe a knowledge of the life-history of this sporozoon.

The first development of cytoryctes variolæ in the host is unknown; it probably takes place in the seat of primary infection, forming an organism which reproduces by "gemmules," or dark points seen within the parasite in some of Councilman's photographs. The gemmules are probably carried in the blood to the skin, where the further development takes place. This early part of the development is purely conjectural, but from this point Calkin's observations are fairly complete. The gemmules become cytoplasmic (intracellular) amœboid organisms, which give rise to further gemmules. This process, which has been designated the vaccine cycle, probably continues for some time, as in variola the gemmules are distributed to all parts of the skin. Later, the gemmules existing thus in the deep epithelial cells, give rise to forms which penetrate the nucleus and develop into gametocytes of two types, one forming the supposed male, the other the female gamete. The gametes apparently conjugate, the zygote thus formed developing into a comparatively large amœboid organism in which sporoblasts originate. These sporoblasts give rise to secondary sporoblasts, and the latter to spores, the entire process taking place within the nucleus of the epithelial cell, and corresponding to the so-called "propagative reproduction" characteristic of certain other sporozoa. The spores thus formed may in turn infect fresh nuclei and grow directly into new secondary sporoblasts, which give rise to similar spores, a true schizogony, and a second means of auto-infection by which the organism spreads throughout the nuclei and cells of the skin, and possibly to many of the other organs of the body. These spores may transmit finally the disease to new hosts.

Experimental variola has been established in monkeys by Magrath and Brinckerhoff, and these observers found bodies identical with those described by Calkin in the life-history of

cytoryctes variolæ as found in man. Their developmental forms corresponded with the evolution of the lesion, and this fact, together with their parallelism to the bodies found in the corresponding lesions of man, points strongly to their being the etiological factor in variola.

Complementary to the foregoing work in respect of variola is that of Tyzzer on the etiology and pathology of vaccinia, in which he shows that in vaccinia bodies exist which have the same forms as those found in the cytoplasmic cycle in variola. He has failed to prove that such bodies are living organisms or to prove that they are the cause of the disease, but the presumptive evidence is very strong that the cytoryctes variolæ is the cause of both vaccinia and variola.

It is a popular belief that persons suffering from small-pox retain the power of infecting others so long as any of the scabs remain on the skin. From experiments made with dried pulverised small-pox scabs or crusts, Brinckerhoff (*Journ. Med. Res.*, xi., p. 284) obtained variolous keratitis in the corneæ of three out of five rabbits inoculated with the dry powder. Some of the scabs were as much as eighty-five days old. He concludes that the contagium of small-pox is present in the scabs or crusts of the disease. The practical interest of these observations is obvious in its relation to the views held on the aerial convection of small-pox. It is easy to imagine a scab being carried long distances by air, and, if Brinckerhoff's results are correct, there is no reason to doubt its ability to infect any person with whom it may come in contact. There is, however, this weak point in Brinckerhoff's experiments: he seems to have used scabs which had been kept in closed bottles till wanted. It would be interesting to know if variolous keratitis could be established in a rabbit by a scab which had been exposed to the air for a week. Should this prove to be possible, the belief in the aerial convection of small-pox will receive considerable support.

The recent claim of de Korté (*Lancet*, December 24th, 1904, p. 1776) that he has detected the parasite of variola, vaccinia and varicella in the form of an amœba in the lymph is of interest, but it is desirable to suspend judgment or further comment until the more precise details of the life-history of the organism promised by de Korté are published.

The Cultivation and Etiological Significance of Amœbæ.—The controversy relative to the etiological significance of these parasites in human disease has undoubtedly been accentuated by the unsatisfactory results following efforts to cultivate them. An important

addition to the literature of the subject has been made by Musgrave and Clegg (*Bull. No.* 18, *Bureau of Govern. Lab.*, Manila, 1904), in which they give not only details as to their own work but also a useful summary of that done by earlier investigators. It would be useless to describe all the various media employed or suggested. Amœbæ from water, soil, hay, &c., can be grown indefinitely on a large variety of them, but for the cultivation of those which have passed through the alimentary canal of man and animals the authors recommend the following: Agar 20 parts, sodium chloride 0·3 to 0·5 parts, extract of beef 0·3 to 0·5 parts, water to complete 100 parts. Prepare in the same manner as ordinary agar. The finished product is most satisfactory when 1 per cent. alkaline to phenol phthalein. In order to obtain a final reaction of 1 per cent. alkaline, it will be found usually necessary to start with an initial alkalinity of 1·5 per cent. as there is a decrease of alkalinity during autoclaving, filtering and other manipulations. An alternative and simpler medium is to use from 5 to 10 per cent. of ordinary laboratory bouillon and 2 per cent. agar in water. The reaction to be the same.

For the isolation of amœbæ, the authors lay stress upon the rule that the patient should always be given a saline cathartic and the examination made from the fluid portion of the stool: this procedure ensures that the entire colon is washed out and amœbæ which may be propagating in it in various places thus flushed out. Another point to be borne in mind is that the diagnosis of the presence of amœbæ should never be made unless they are in a motile state. For staining, any of the following dyes may be used: borax carmine, hæmatoxylin and eosin, gentian violet, saffranin, iron hæmatoxylin, or Romanowsky's stain.

Satisfactory pure cultures of amœbæ have not yet been obtained, and recent work points to the impossibility of such a procedure, because a complementary symbiotic living organism is indispensable for the nourishment of these protozoa. Owing to the selectiveness of amœbæ for certain bacteria, and particularly of amœbæ from the intestine on their first transplant, in order to grow them with any constancy the surface of several plates should be smeared with pure cultures of various kinds of bacteria and then lightly smeared with material selected from fæces containing amœbæ. There are no means of determining beforehand what organisms will be satisfactory to an artificially uncultivated amœba, but by using a variety, comprising from six to twelve species, the percentage of positive results can be very much increased. When it is desired

to cultivate amœbæ from any particular intestine the chances of obtaining growth are increased by first making cultures on ordinary agar plates from the intestine and using the bacteria which develop as symbiotic aids when the material containing the amœbæ is added. Amœbæ containing red blood cells appear incapable of reproduction, and it is possible that there are other conditions of environment or phases of the life cycle which play an inhibitory *rôle* in certain cases. The first plates taken from the stool or fæces must be watched frequently and carefully under the microscope, and as soon as it is found that amœbæ have developed, which they do in from twenty-four hours to five days, transplants must be made. If this is not done promptly, the parasites are liable to die, but when once they have become accustomed to the artificial media less difficulty will be found, possibly because they become less selective as to their symbiotic micro-organisms. On the other hand, it must be remembered that the phenomenon is reversible, for, by passing the amœbæ through the animal economy, the selectiveness may be increased. Another factor, which is not easy of explanation, is also encountered, namely, an acquired resistance to culture, apparently due to causes other than the lack of a satisfactory bacterial environment or symbiotic relationship. This is specially seen in the case of amœbæ from hepatic abscesses and dysenteric intestines. It may be that living bacteria are not really necessary to the life of amœbæ under all conditions. Another question of importance in regard to this selectiveness and its variability is, does varying symbiosis, in addition to increasing the difficulties of cultivation, influence in any way the pathogenic nature of the parasite? Some experiments given by the authors suggest that it is not the nature of the first symbiosis but that of the one formed with the bacteria already in the intestine which determines pathogenicity; more work is, however, needed on this point.

The distribution of amœbæ is undoubtedly wide, being found in all varieties of water, soil, grass, hay and fruits. They have been found, too, in the digestive tracts of frogs, chickens, pigeons, lambs, calves, rabbits, dogs, cats, horses and monkeys.

The optimum temperature for cultures, as reported by different authors, varies greatly, but as a rule it may be said to lie between 20° and 28° C. Some, however, have found 37° C. to be the most satisfactory. The authors quote Gottstein as giving the optimum at 20° to 22° C., the minimum at 10° C. and the maximum at 37° C. Tsujitani says that encysted amœbæ are killed by ten minutes'

exposure to a temperature of 60° C.; Celli and Fiocca consider 45° C. for five hours, or 50° C. for one hour, to be sufficient to kill them in the amœboid stage, whereas 60° C. for one hour does not destroy them in the encysted one. Musgrave and Clegg find differences between amœbæ from different sources.

As to the etiological importance of amœbæ in the intestinal and other infections with which they have been associated, the authors say they do not wish to state that amœbæ are never present in the normal colon, for such may be occasionally the case; but whatever may be the effect of transient presence of amœbæ in the normal bowel it is much less frequent than generally believed. Further, all amœbæ are or may become pathogenic, but the sharp division between pathogenic and non-pathogenic has not been demonstrated. Infection in the colon of monkeys follows the feeding with amœbæ; in one instance amœbæ cultivated from a dysenteric intestine with a certain bacillus produced clinical amœbiasis by ingestion in man, while the cultures of the bacillus alone failed to produce such symptoms. Amœbæ are the etiological factors in the disease known generally as amœbic dysentery, and by following the methods described by Musgrave and Clegg such amœbæ may be grown upon artificial media, and the disease produced in monkeys and man by ingestion of these cultures. Amœbæ may be isolated by culture from the stools or the intestinal ulcers.

Recent Work as to Immunity.—If the past year has not been remarkable for the demonstration of notable success in the practical acquirement of immunity, it has been certainly rich in work for the better understanding of the many phenomena which contribute to that complicated and much-discussed question. As pointed out by Ritchie, in his able summary, of our knowledge regarding immunity (*Brit. Med. Journ.*, September 10th, 1904, p. 557), the most important recent pieces of work bearing on this subject are the three following: First, that of Meyer and Ransome (*Proc. Roy. Soc.*, July 8th, 1903), which established the fact that tetanus toxin reached the nerve cells by the path of the motor axones only, while their further observations went to show that antitoxin was conveyed to the nerve cells by the much slower route of the lymphatics, thus explaining the experimental fact that the injection of a very large excess of antitoxin would not protect an animal against the subsequent introduction of even a small amount of tetanus toxin into a motor nerve. If this observation is confirmed it destroys the theory advanced by Ehrlich that antitoxin was formed in the nerve cells. A summary of this work of Meyer and Ransome has already been

given in this Journal (vol. iii., No. 3, p. 324). Next, the work of Wright and Douglas (*Proc. Roy. Soc.*, lxxii., p. 357), which has consisted in the elaboration of methods of precision, enabling them to study the laws which govern the phenomenon of phagocytosis, and to demonstrate the presence in the serum of a substance they term "opsonin," whose function it seems to be to unite with bacteria and, by a process of sensitisation, render them capable of ingestion by the phagocytes. Finally, the work of Muir, on the interaction of the constituents of hæmolytic sera, which went to prove that when corpuscles were thoroughly saturated with immune body, it was possible to dissociate a certain amount of immune body, and cause it to become attached to fresh corpuscles; and further, that when red blood corpuscles were saturated with both immune body and with complement, still some of the immune body, but none of the complement, could be dissociated from the combination. It is obvious that these observations are incompatible with the view that the immune body formed a link between corpuscles and complement.

In considering the saturation phenomena of immune body and red corpuscles, Muir has pointed out its similarity to the process of neutralisation of toxin by antitoxin, as explained by Arrhenius and Madsen. It may be remarked, further, that the amount of immune body which enters into combination is not a fixed quantity, but varies with the amount of immune body present, and that the reaction is, in fact, an example of mass action; similarly, the combination of complement and anti-complement follows the same physical laws, and in both cases the combination is a reversible process. With regard to the mode of action of complements, recent work indicates that complement is analogous to toxin, and, like it, possessed of two chief atom groups—namely, a combining group and a toxic group. The latter is much more labile than the combining group, and can be destroyed by heat, while the other perishes. Turning to the question of variations of toxic activity as contrasted with combining affinities, recent experiments show that the therapeutical efficiency of a bactericidal serum depends not only on the ready combination of the complement concerned through the medium of the immune body, but the bacterium must be sensitive to the toxic group or element in the complement. The importance of this is manifest.

It may be asked, does the year's work point to any fuller understanding of the nature of immunity? On the whole I think it does. It certainly suggests the development of a greater harmony between rival schools and between the views of champions of rival theories;

so much is this so that it would seem that the differences are more those of words than of facts. Undoubtedly the main point still is that the French school attributes to the leucocyte a more important *rôle* than that admitted by the Germans, but may it not be that this divergence of views arises from a too rigid adherence to the conception that immunity is always either bactericidal or antitoxic. Now, as Bulloch has pointed out, our practical experience of immunity, as presented in the case of most common infective diseases, shows it to be neither bactericidal nor antitoxic, but that it is brought about by the coalition of both cells and serum. It is in connection with this aspect of the question that Wright's and Douglas' observations on opsonic action are so interesting, for, while not explaining the actual part played by the cell or leucocyte, they clearly show that the bacteria are altered in some way by substances in the serum before being ingested by the cells. It must be admitted that the evidence is not yet complete, but it is needless to say that if it be substantiated the results will be far-reaching, and modify materially existing views of the chemical relationships of the substances concerned in immunisation against bacterial invasion.

The Agglutination of Bacteria.—Although the same interpretation and the same importance may not be attached now to the phenomenon of agglutination as was accorded a few years ago, still the subject presents many interesting features as bearing upon the greater problem of immunity. Recent work tends to throw some light upon the need of differentiation between flagellar and somatic agglutinins, and between specific and non-specific agglutinins. An interesting paper upon the non-identity of agglutinins acting upon the flagella and upon the bodies of bacteria, by T. Smith and A. L. Reagh (*Journ. Med. Res.*, August, 1903), is very suggestive. They show that, when a culture of the hog cholera bacillus belonging to a motile strain was exposed to serum from an animal immunised with a similar motile strain of the bacillus, large loose flocculi appeared at once; whereas, if serum derived from an animal immunised toward a non-motile variety was mixed with the motile culture, the clumps were fine or powdery, and formed slowly. They demonstrate that the loose flocculi were produced by a flagellar agglutinin, while the fine clumps were due to a somatic (body) agglutinin. The separation of these substances was effected by means of absorption experiments. A "motile" serum was first saturated with a non-motile culture, then the mixture was centrifugalised and filtered to remove the bacilli. Serum thus treated was found to have lost largely its power of clumping non-motile

bacilli, while its full action as to motile forms was unaffected; the obvious deduction being that the somatic agglutinins had been absorbed by the non-motile bacilli, leaving the flagellar agglutinin in the serum. In a similar manner nearly all the somatic agglutinin could be removed from a "non-motile" serum by adding an excess of motile bacilli. The non-identity of the flagellar and somatic agglutinins co-existing in "motile" serum was thus established, and also the identity of the somatic agglutinins of sera derived from an immunisation by both motile and non-motile varieties of a bacillus.

It is now generally believed that the agglutination of bacteria depends upon the union of an agglutinable substance within them to the agglutinin of the specific immune serum, and that the presence of a salt is necessary for the occurrence of such agglutination. Joos, in an interesting paper (*Centr. f. Bakt. u. Parasitk.*, xxxiii., No. 10, May, 1903), has described two agglutinins as existing in the serum of animals immunised against the enteric bacillus, and which are evidently the same in nature as the flagellar and somatic agglutinins of Smith and Reagh. He further recognises the existence of distinct agglutinable substances in both the flagella and bodies of the bacilli. According to Joos, a temperature of 60° C. to 62° C. maintained for an hour, is sufficient to destroy the somatic but not the flagellar agglutinins; the same exposure impairs the flagellar agglutinable substance, but not the somatic agglutinable substance. Work on the same lines has been done by Eisenberg and Volk, also by Wassermann and Kirstein (*Zeitsch. f. Hyg.*, 1904, xlvi.), but it is not quite concordant with Joos' results, as they succeeded in producing agglutinins in animals with bacteria which had been either heated to 80° C., or exposed to dilute acids, or dried and triturated. They further show that when bacteria are modified by heat or acids so that they are no longer agglutinated, these modified bacteria are still capable of combining with and abstracting agglutinins. This they attribute to the existence of a stable combining (haptophoric) group and an unstable agglutinophoric group in the bacteria. Two similar combining and agglutinating groups were demonstrable in the agglutinins of blood serum; they further explain and speak of the formation of agglutinoids (comparable to toxoids), by the influence of heat, acids, &c., upon the agglutinins, and state that these agglutinoids possess so great an affinity for the bacterial agglutinable substance as to be able to prevent agglutination—in the presence of unchanged agglutinin even—by combining with the combining groups (haptophores) of the bacteria. Eisenberg and Volk, in investigating compounds formed by

bacteria and agglutinins, found that the absolute absorption of agglutinin by a constant quantity of bacteria increased with increasing quantities of agglutinin, while the ratio of agglutinin absorbed by bacteria to agglutinin originally present, fell. The suggestion that heating destroys the agglutinable substance of bacteria has been denied by Dreyer and Jex-Blake (*Brit. Med. Journ.*, September 10th, 1904, p. 564), as certain experiments of theirs showed that prolonged heating—from two to thirteen hours—at 100° C. partially or even entirely restored its agglutinability, a phenomenon which they explain by assuming that the agglutinin fixing body, which is dissolved out during the early stages of the heating, is finally destroyed by prolongation of the heating process. They also suggest that change in bacterial surface tension may have something to do with the facts. Later work by Beyer and Reagh (*Journ. Med. Res.*, October, 1904), indicates that a higher temperature is required to differentiate the flagellar and somatic agglutinins of the hog-cholera bacillus than Joos found to be necessary in separating the corresponding substances of the enteric bacillus. A temperature of 70° C., which is sufficient to destroy the agglutinating power of motile hog-cholera bacilli, does not affect their power of generating the flagellar agglutinin in the animal body.

The importance of differentiating between or recognising the existence of specific and non-specific agglutinins in sera is very apparent when one is engaged in attempting to co-ordinate the agglutinating characteristics of certain closely-allied bacilli, say, for instance, the dysentery and para-dysentery bacilli, and others of a like affinity. It is well known that the protoplasm of a single variety of bacteria, when injected into a suitable animal, excites the production of a number of agglutinins. Some of these are specific, inasmuch as they have an affinity only for the protoplasm of the variety injected or nearly identical with it. The others have an affinity for substances found in other bacteria only remotely allied to the variety infected. These may be termed non-specific agglutinins. Our lack of recognition of the varying relative strength between the specific and the non-specific agglutinins in the serum of animals, both before and after immunisation, has led to many conflicting statements. This probably explains the discrepancies which exist as to the action of various dysentery sera, as the serum of horses used is not unfrequently rich in common or non-specific agglutinins. These have often been produced before immunisation by the passage of bacteria or their products into the body of the animals. An interesting paper on this question has been published by Park and

Collins (*Journ. Med. Res.*, November, 1904), in which they point out that if an animal be injected with a particular bacillus for a long time the amount of specific agglutinins will rise to a certain height, and then more or less rapidly diminish. At the same time the common agglutinins will also diminish, but they may do so more slowly. The relative amount of specific to non-specific agglutinins thus varies, and a time may come when in the blood the non-specific may equal or exceed the amount of specific agglutinins. Thus the serum of a horse immunised against a para-dysentery (mannite fractor) bacillus, agglutinated not only that bacillus, but also a variety of *B. coli*, at a dilution of 1 in 10,000, The serum of a goat treated with the same *B. coli* clumped it at 1 in 2,000, but the para-dysentery organism only at 1 in 50; later on as immunisation was pushed, the para-dysentery bacillus was clumped at 1 in 3,000, while the colon bacillus was agglutinated in dilutions but a trifle higher, or 1 in 5,000. The recognition of these facts impel us to modify, or at least to limit, the importance which we attach to the circumstance of a serum agglutinating, or failing to clump at high dilutions any given micro-organism. As a rule, only the serum from young animals which have received but a few recent injections of a single organism will give us a serum having mostly specific agglutinins for that organism. Further, we have to bear in mind that the addition of non-specific to the specific agglutinins existing in a serum, tends to raise the agglutinating strength of the serum for the specific micro-organism.

Spirillar Fever and Trypanosomiasis.—Some highly important and most interesting advances have been made during the year under this section; more particularly as to the metamorphosis of certain protozoa, the differentiation of a parasite in kala-azar, and the cultivation of parasitic trypanosomes. The comprehension of this work cannot fail to modify our ideas of the nature of certain blood parasites.

Schaudinn's remarkable monograph (*Arbeiten aus der Kaiserl. Gesundheitsamte zu Berlin*, vol. xx., part 3, 1904) on the change in generation and host in trypanosoma and spirochæte, merits special attention, if only for its suggestiveness. His observations were made upon the blood of the small stone owl of Southern Europe (*Athene noctua*) and have a most important bearing upon the life-history of trypanosomes generally, besides tending to displace the *Spirillum Obermieri*, the cause of relapsing fever, from the position it has occupied hitherto as a bacterial agent, and to place it among the protozoa. His observations show that the spirillum is but a

phase in the life of a trypanosome, that it possesses at one stage of its existence the large nucleus and micronucleus characteristic of the trypanosomes, and further, that it is capable of changing its shape and assuming forms very different from the familiar spiral thread. While still nucleated, it may contract and assume an oval form; these oval nucleated bodies may be absorbed by leucocytes and come still more to appear like different or distinct parasites. Schaudinn found in the blood of the stone owl, not only a proteosoma, but two other parasites, namely, a halteridium and the leucocytozoon of Danilewski and Ziemann. The latter is in some respects the more remarkable. Schaudinn calls it *Trypanosoma Ziemanni*, and finds that two forms exist in the owl's blood, one being the more slender and with a longer flagellum than the other. The larger form represents a female egg-cell or ovum, the smaller a male or mother sperm-cell. Fertilisation takes place in the intestine of a mosquito, *Culex pipiens*, the resulting giant ookinet producing an enormous number of trypanosoma-like buds (neutral trypanosomes), which become transformed into spirilla or spirochætæ. These flagellated bodies are the spirilla of older authors, and have hitherto been regarded as bacterial parasites; they are, however, stages in the life of a protozoon, and, after wandering into the Malpighian tubes, multiply by fission. Should the gnat bite another bird, some of these spirochætæ or neutral trypanosomes are introduced into its blood, multiply there by fission, differentiate and eventually give rise to the original sexual forms with which the cycle started. There appear to be considerable variations as to the shape and grouping of these spirillar forms, ranging from contracted or resting states to star-like agglomerations due to a coming together of free individuals, and not to any fission or budding process. The chief interest of these observations lies in the fact that it throws fresh light on the nature of the *Spirillum* or *Spirochæta Obermieri* of relapsing fever, which has long been known to differ from the ordinary bacterial spirilla in being pointed at both ends and in its flexibility, and, moreover, cannot be cultivated on ordinary media. In the light of Schaudinn's statements, there can be little doubt that the spirillum of relapsing fever is a protozoan parasite, probably a phase in the life of a flagellate, and possibly inoculated by some biting insect.

As to the halteridium infection of the stone owl, Schaudinn's work is equally interesting. He shows that the halteridium is the sexual stage of a flagellate (he calls it a trypanosome), which multiplies in *Culex pipiens*, and, after a complicated passage through the

body of that mosquito, is again introduced by its bite into the owl's blood, where it undergoes sexual multiplication, finally being transformed into the male and female halteridium. The mosquito sucks some of this blood into its stomach, the male cell there produces a number of spermatozoa or microgametes in the form of elongated animalcules, which, becoming free, seek out the female cell. One of them enters and fertilises it. This phase is comparable to the ex-flagellation of crescents and the fertilisation of the malarial parasite, with the resulting formation of the ookinet, or travelling vermicule. In malaria the vermicule comes to rest in the wall of the mosquito's stomach, there enlarges, and finally gives origin to worm-shaped bodies or spores, which migrate to the salivary glands of the mosquito, and are injected into the blood of man during the act of biting. They enter subsequently the erythrocytes and carry on the well-known malarial life-cycle. In the case of the halteridium infection of the owl, the vermicular bodies enter the Malpighian tubes of the mosquito, and after multiplication pass to the œsophagus, and thence by the bite to the blood of the owl, where they enter the red cells, become stationary and grow to about double their original size. After about forty-eight hours' stay within the erythrocytes, the young parasite escapes as a gregarine-like body which develops a kind of flagellum. This escape from the red blood cell appears to take place at night, after a period of motility in the flagellated or trypanosome-like condition, the parasite again invades a red cell, when the same process is repeated. This goes on for about six days, when maturity seems to be reached. On its migration from the blood-cell at this stage it multiplies by rapid longitudinal divisions until the products have attained the lowest limit of size. These minute flagellates again attack the erythrocytes, and so the process goes on until the blood swarms with mature male and female forms. Under certain conditions both the halteridium and spirillar forms can reach the ovaries of the mosquito, and there induce an infection of the next generation of the insects. Schaudinn further points out that the female forms in the gregarine stage may undergo a kind of auto-fertilisation; there the micro-nucleus approaches the nucleus and, after certain changes, a new ookinet is produced, which now possesses the power of development. This may happen both in the mosquito and in the owl. He suggests that this explains some relapses in trypanosomiasis, and that possibly relapses in malaria may be also accounted for by a like parthenogenesis.

That Schaudinn's observations are likely to have far-reaching

effect is strikingly emphasised by recent work on kala-azar and tropical splenomegaly. The recognition by Leishman of a special parasite in this disease has been fully confirmed, and interest now centres chiefly in the question of its life-history. As regards the nature of the parasite, Leishman suggested that it might be a developmental form of a trypanosome; Laveran thought it to be a piroplasma, and Ross that it might belong to a new genus of the sporozoa. The successful attempts by Rogers, Chatterjee, Statham, and Leishman to obtain a flagellate organism in artificial culture media from these parasites, obtained directly from the spleen pulp of cases of this disease, go far to endorse the correctness of the original view put forward by Leishman. Future work in this direction cannot fail to be of the supremest interest, as it concerns intimately the question of an intermediate host as well as the mode of entrance and exit of the parasite. From the fact that the only successful attempts to obtain flagellated forms from these bodies have been carried out at low temperatures, it is legitimate to infer that the unknown host is probably a reptile or fish rather than a mammal or a bird. Wright's observation that he has found similar parasitic bodies in a case of tropical ulcer, and Manson's statement that the same forms are to be found in certain lesions of the bowel, are not inconsistent with the idea that the possible route of escape for the parasite is by an ulcerated surface. It must be borne in mind, however, that collateral evidence in support of these speculations is wanting.

The cultivation of trypanosomes has been successfully carried out by Novy and McNeal (*Journ. Amer. Med. Assoc.*, November 21st, 1903), who, by making use of a special medium, succeeded in cultivating *T. Lewisi* of the rat and *T. Brucei* of Nagana. The medium consists of ordinary broth agar with the addition of a variable proportion of defibrinated rabbits' blood. After the last sterilisation, when the agar has cooled to 50° C. or 45° C., and is still fluid, a quarter to half its volume of aseptic defibrinated rabbits' blood is added, mixed in and the whole allowed to solidify. In the condensation fluid which forms on the surface of such a medium the trypanosomes of the rat grow freely if inoculations be made with the blood of an infected animal and the culture kept at blood heat. The inoculations of the Nagana trypanosome are made similarly, but there is much more difficulty in starting a culture than in the case of the rat trypanosome, and a large proportion of the inoculations fail to grow. Once having obtained a culture, however, subcultures take readily, and in both cases a culture may be subcultured again and again.

Ankylostomiasis.—This affection is well-known to be one of the commonest diseases in tropical and sub-tropical countries, but it is only recently that attention has been directed seriously to its endemic prevalence in certain parts of this country and other places in Europe (Haldane, "Report to Home Secretary on an Outbreak of Ankylostomiasis in a Cornish Mine, 1903," also "Report to Home Secretary on Ankylostomiasis in Westphalian Collieries, 1904"). Its main symptoms are those of anæmia, due to the presence in the upper part of the small intestine of small worms of the species most commonly known as *Ankylostoma duodenale.* The worm was originally discovered by Dubini in Italy, in 1838, but its definite association with anæmia was due to Griesinger's work on Egyptian chlorosis, in 1854. A few years later Wucherer showed that the anæmia so common in Brazil is ankylostomiasis, and the disease has since been identified in many other countries. A very serious outbreak of anæmia among the men working in the construction of the St. Gothard tunnel about twenty years ago was shown by Perroncito and others to be ankylostomiasis. In recent years the disease has spread and been recognised in Belgian, French, German, Austrian, South African, Australian and English mines as causing much sickness and trouble, hence it may be taken for granted that ankylostomiasis exists among the miners in nearly all tropical and warm countries, but exact information on the subject is still somewhat scanty.

As the successful prevention of the spread of this disease depends mainly on a knowledge of the conditions under which the ankylostome propagates itself, a brief review of the life-history of the worm from this point of view may be of value. In man, the location of the adult male and female worms is limited practically to the upper part of the jejunum. Here they may live for several years, certainly five to six years, while in some cases there is evidence that they may soon die out. Recognising that the adult worms are capable of considerable longevity, it is evident that a person who has once been even slightly infected may, if the conditions be favourable, spread the disease many years after and perhaps in some other country. Into the bowel of man, the female adult worms emit large numbers of eggs, but though these eggs must remain often for several days in the intestine they are never very far advanced in development when passed from the human body. The reason why they do not develop beyond the morula stage in the intestine is probably due to the fact that the eggs require free oxygen for their development. The ova are usually

evenly distributed in a given sample of fæces and, when the fæces are exposed to air outside the body and kept from drying, will develop or hatch within a wide range of temperature. After the ovum has reached the morula stage it bends round within the shell like a comma, as the body elongates it shows active writhing movements, finally, on rupture of the shell, emerging as the larva. The eggs are killed in about twenty-four hours by exposure to a temperature above 40° C. or below 0° C. They may hatch at any temperature from 16° C. to 38° C. (61° F. to 100° F.), but at these higher temperatures the hatched larvæ rarely survive. Between 30° C. and 16° C. nearly all the eggs are hatched within five days, but the critical point seems to lie somewhere between 13° C. and 16° C. (55° and 60° F.).—(Boycott and Haldane, *Journal of Hygiene*, vol. iii., No. 1, also vol. iv., No. 1). After hatching and given suitable conditions, the larvæ continue to grow and, after moulting once at least, reach a stage at which they are actively motile and some 0·6 mm. long. A chitinous sheath is now very prominent, so much so that the larva is practically encapsuled, and outside the human body never passes beyond this stage, in which there are also absent all signs of sexual difference or mode of reproduction. While four to eight days are needed to hatch the eggs at say 16° C., another three to four weeks are required for the larvæ to reach the encapsuled stage. This time may be prolonged if at intervals they be exposed to lower temperatures. Having become encapsuled the larva has reached the infective stage, as it is in this form that it passes into man and within his body undergoes further stages of development to the adult form. In addition to an optimum temperature of about 25° C. (77° F.), moisture, short of actual immersion, and a fairly free supply of oxygen are necessary for the development of the eggs and for the growth of the larvæ. On the other hand, exposure to direct or even diffuse sunlight is sufficient to retard development and even kill within forty-eight hours. Susceptibility of the eggs and larvæ to disinfectants is variable. Owing to the chitinous shell the eggs are very resistant to disinfectants other than strong mineral acids and the hypochlorites. The action of re-agents upon the larvæ depends upon their stage of growth. In their earliest form and without a chitinous capsule, they are readily killed by disinfectants, but once having become "encapsuled" they show greater resistance. Practically 0·1 per cent. of mercuric chloride and 1 per cent. of izal are capable of killing the most resistant forms within twenty hours, and probably minute quantities of formalin would be equally efficacious against both eggs

and larvæ. How long the eggs and larval forms will live without coming into relation with human beings is unknown, though a matter of importance. What evidence there is indicates the longevity, under favourable circumstances, of the eggs to be six weeks and of larvæ some six months; but it is not improbable that obscure conditions of soil, apart from temperature and dampness, influence the development. In this connection a statement by Stiles (*Journ. Amer. Med. Assoc.*, vol. xl., 1903) is interesting; he says that ankylostomiasis in the Southern States of America is confined chiefly to dwellers on sandy soil, while those on clay are relatively immune.

Reference has been made already to the fact that the developed (encapsuled) larval worm is the true infective stage of the ankylostoma. Some observations made by Leichenstern (quoted by Boycott and Haldane, *op. cit.*) show that if ova or freshly developed larvæ are swallowed by man, the adult worm does not develop in the intestine; on the other hand, if the encapsuled or fully developed larvæ be swallowed, adult parasites develop and their ova appear in the fæces of the host after about a month. The next question is, what are the paths of infection? Clearly one path is by the mouth and probably is the most frequent, but it is not the only path. Loos and Pieri's experiments, also Bentley's observations in Assam and those of Boycott and Haldane at Dolcoath in Cornwall (*op. cit.*), show that infection may result by direct passage of the fully developed larval forms through the skin, which not infrequently may be inflamed and be the seat of furuncles as the local effects of infection. We can readily understand, in the light of these facts, how miners, brickmakers, agriculturists and others handling damp and infected soil, may get infection through the skin as well as by the mouth, though the risk of infection by this latter channel during such work must be equally great. It is evident that many points with regard to infection through the skin, not only by larval forms of ankylostoma, but by other similar parasites, remain to be cleared up and offer a promising field for accurate observation by officers of our Corps. Reference may be made here to the fact that *Anguillula intestinalis* or *Strongyloides intestinalis* is also capable of penetrating the skin of animals and producing a pustular eruption (see Thompson-Yates' Lab. Rep., 1902, p. 471). How far this nematode is pathogenic to man is uncertain, but it is in frequent association with ankylostoma and worth bearing in mind.

It is evident, from the life-history of the ankylostoma, that any

attempts at prophylaxis are summed up in efforts to prevent the ripe larvæ entering the body. This can be secured either by personal hygienic precautions against ingestion of larvæ by the mouth and skin infection, or by precluding development of larvæ once the eggs leave man's body. Air-borne infection is most improbable; in mines and agricultural pursuits the most serious risk of infection is by dirty hands and dirty pipes. If contamination of the ground by human fæces can be prevented there is no possibility of ankylostomiasis spreading, as ripe larvæ then cannot reach those who would otherwise be exposed to infection. As the disease is absent as an endemic affection in any town or community with a moderately good system of excreta removal, the elaboration of some such system is clearly the simplest preventive measure.

Destruction of Rats on Shipboard.—Although the precise part which rats play in the dissemination of plague is not known, the knowledge of means for their destruction, especially on shipboard, constitutes an important means of defence in port sanitation. A joint report on the subject, by Dr. Haldane and Dr. Wade, has been issued by the Local Government Board, in which the former furnishes observations on the Clayton process as used at Dunkirk, and the latter gives the results of experiments with the same process and ordinary burning of sulphur at Blackwall. For the treatment of a vessel's hold the Clayton method of employing sulphur dioxide under pressure possesses distinct advantages. In the first place, the process of filling the hold with the gas can be carried out simply by gravitation. The gas must in time find its way to the bottom, because it is heavier than air. In the second place, the process is perfectly safe. A third advantage is that the gas, unlike carbonic oxide, kills insects. A fourth point is that the gas produced by the Clayton apparatus is a very efficient disinfectant, provided it penetrates. The disadvantages of the process are that it causes serious damage to various articles of food; it is absorbed by articles of cargo, and therefore penetrates a cargo mass very slowly. It is thus not nearly so rapid in its action in holds filled with cargo as in empty holds, cabins, &c.

The process of burning sulphur is not applicable to holds full of cargo, on account of fire risks. The proportion of sulphurous acid in the air of a closed space by simply burning sulphur in it is only about 2 or 3 per cent., but this is shown by Wade's report to be sufficient to destroy all animals, and to produce a fairly satisfactory disinfecting action within a few hours. At least $1\frac{1}{2}$ lbs. sulphur per 1,000 cubic feet of air space appears to be needed, but

the process is tedious, and involves distinct risks of fire. Liquid sulphurous acid gas can be employed for both full and empty holds. It is more expensive than sulphurous acid prepared directly by combustion of sulphur, but it seems to cause less damage to cargo than the Clayton gas or the burning of sulphur. The cost of liquid sulphurous acid, sufficient to produce an average of 2 per cent. mixture with air in the empty holds of a 3,000-ton vessel, would probably be about £15, while sulphur sufficient to produce the same effect on combustion would cost about £5. The saving of time, trouble and risk of fire, would probably more than repay the greater cost.

As alternatives to sulphurous acid, the employment of carbonic oxide and carbonic acid have been recommended. Carbonic oxide is now in actual use for destroying rats on loaded vessels at Hamburg. Its advantages are that it can be cheaply and easily made, causes no damage to, and is not absorbed by, cargo. On the other hand, it has these disadvantages : it has no disinfectant action and no effect on insects; as it has practically no smell it is dangerous to man unless used with precaution; it is capable, under certain conditions, of forming an explosive mixture with air; it is rather lighter than air, hence does not pass downwards by gravitation. Carbonic acid has been used successfully for destroying rats on ships at Marseilles. It has the advantage of causing no damage to cargo; it is heavier than air; it is much less dangerous to man than carbonic oxide, since it causes shortness of breath and extinguishes lights before it is dangerous to life. Its disadvantages are that a very large amount of it is needed to kill rats and mice, practically 30 per cent., so that in treating a ship an enormous amount has to be generated; it is not a disinfectant, and cannot be relied on for killing insects. The gas is supplied from a large number of steel cylinders of liquid carbon dioxide, which are stored on a barge provided with special arrangements for conducting the gas into the holds and for displacing afterwards the gas by air.

The choice as to which of these processes is to be employed will depend largely on the circumstances. If all vessels from plague-infected ports, whether infected or not, are to be treated, the cost of materials and of damage producible by the sulphurous acid will be serious items, so much so that the carbonic oxide would be the more preferable. A skilled staff of men capable of handling carbonic oxide with safety to all on board would, however, be a necessity. In cases of known infection of vessels the treatment with carbon monoxide would need to be followed by a separate disinfection pro-

cess. In view of all the circumstances, I think the sulphur dioxide process will be the more generally useful and, provided the necessary apparatus could be supplied and worked at a reasonable cost, the Clayton method be best adapted for use in large British ports. The main doubt is the penetrative power of sulphurous acid from the Clayton apparatus. Possibly this difficulty could be overcome by adding to the sulphur dioxide some 10 per cent. of carbonic oxide. Wade's experiments show clearly the high penetrative power of carbon monoxide, and, if mixed with sulphurous acid, the risk of accidental poisoning would be small. The diminished proportion of oxygen in the interior of cargo treated by the Clayton process would increase the toxic action of the carbonic oxide on rats, which could be destroyed thus with certainty, while a certain amount of true germicidal action would be secured also. The use of liquid sulphur dioxide has evident advantages on the score of convenience, safety, and absence of capital outlay, but whether it can be used so as to be effective in full holds is doubtful; in empty spaces it is distinctly advantageous.

Lead Poisoning and Water Supplies.—The apparently inscrutable behaviour of certain waters, especially soft moorland waters, in regard to plumbo-solvent ability, may be said to be now understood. For this explanation we are indebted to the work of Houston on behalf of the Local Government Board (*Supplement in continuation of the Rep. of the Med. Off. for* 1901-2), which forms, with the earlier papers issued by the Board on the subject, a valuable contribution to the literature and science of public health. Preliminary inquiry had shown that the plumbo-solvency of any water was associated always with corresponding variations in the amount of acid in the water. Extended inspection and investigation of all the chief moorland gathering grounds of Yorkshire and Lancashire has shown that the cause of the plumbo-solvency is due to the acid in the waters, which acid is formed by contact of the water with the moist peat on the catch-ground, and that the formation of the acid is due to the presence of acid-producing bacteria in the peat itself. An important point is brought out in this Report to the effect that there is a difference in kind of action exercised by water on lead. In one case the action (plumbo-solvency) is brought about by acidity of the water; in the other the action (erosion) is an inherent property of water containing dissolved air. The erosive action, as distinguished from the true solvent action of acid waters, shows itself by the formation of a relatively insoluble compound or powder (oxyhydrate of lead), which may tend to fall away from the surface

of the metal and so permit of progressive action. Fortunately, however, erosion takes place only to any large extent when the lead is bright, and, moreover, most natural waters contain ingredients which prohibit the action. Neutral distilled water erodes lead vigorously. Interesting as this phase of the subject is, it is quite secondary in practical importance to the question of plumbo-solvent ability, which is due to acid in the water derived from acid peat, and formed by acid-producing bacteria in the peat itself.

As to remedial measures, the experiments seem to indicate that in practice it might be cheaper to resort to a preliminary lime or combined lime and sand filtration treatment than by employing carbonate of sodium, by this means correcting acidity, plumbo-solvent ability and gross erosive power, and then supplementing this procedure finally with a further addition of sodium carbonate in minimal quantities so as, by endowing it with a reserve of protective substances, to place the water in a condition in which the possession of erosive ability would be impossible. There seems to be this difference between erosion and plumbo-solvency, that any mere neutralising treatment, even if carried out imperfectly, always renders an acid water, as regards plumbo-solvency, less dangerous than before; whereas, as regards erosive ability, insufficient treatment may produce no appreciable inhibition, and may in certain cases render such partially treated water more prone than before to attack lead. The report contains remarks on the question of standards, in which it is suggested that a water to be "safe" should give a neutral reaction with lacmoid solution of an ascertained activity, and should also fail to dissolve an appreciable quantity of lead when filtered through a glass tube of lead shot under the conditions described in the report. Similarly, waters should be tested as regards erosion by placing them in contact with bright lead. These standards may be taken to indicate in a public supply a degree of risk which calls for prompt recognition by public authorities.

Alcohol as a Food.—A fruitful source of discussion in the past has been the question concerning the action of ordinary alcohol when introduced into the alimentary canal of a living animal; whether, like grape sugar, from which it is derived, it is carried to the tissues and there oxidised, supporting life, giving off heat and energy; whether, in fact, it acts as a food or not. Some sixty years ago Liebig classed ethyl alcohol as a carbohydrate, and it was not till the publication of the work of Lallemand and other French observers in 1860, that Liebig's original view was challenged. A few years later Binz showed, in confirmation of the earlier state-

ment of Liebig, that alcohol is oxidised in the living organism, forming in that way a source of heat and energy to the body, and that quite a small proportion of it leaves the body unchanged in the excretions and expired air. From the diametrically opposite views expressed by the French observer on the one hand and Binz on the other, it was obvious that the whole subject required further investigation. The recent researches of Rosemann and Neumann in Germany, Atwater and Beebe in America, and Goddard in this country (*Lancet*, October 22nd, 1904), compel a reconsideration of the dietetic conception of the value of alcohol. Laboratory experiments (apart from the animal body) on alcohol show that it can be oxidised in successive stages into acetic aldehyde, acetic acid, and finally into carbon dioxide and water. This suggests that these may be the exact gradations which take place actually in the living body. Recent experiments by the above-quoted observers show this to be the case *plus* the formation of alkaline carbonates from the closely allied acetates; but the full sequence of events is subject to certain conditions as to dosage. When alcohol to the amount of $\frac{1}{750}$th part of the body weight is administered a bare 5 per cent. of that amount is excreted, and since no aldehyde or other alcohol derivatives are found in the expired air, in the urine, blood, or in any part of the body, we may conclude that 95 per cent., or the remainder, is made use of as a food. If double the quantity of alcohol be administered some 6 per cent. is excreted, and acetic aldehyde is capable of detection in the expired air. If a still larger dose be given, rather more than 49 per cent. of alcohol or its derivation is excreted, in other words, there is an absolute failure on the part of the animal body to utilise about half of the quantity of alcohol administered. Alcohol, therefore, in small doses, is undoubtedly a food, but as when large doses are taken about 50 per cent. of it is excreted, it cannot then be considered a true food, and if still larger quantities be taken this contention applies with even greater force. These conclusions coincide with common experience, that beyond certain limits the poisonous action of alcohol more than counterbalances its food value. As illustrative of this view, Beebe's experiments are of especial value, because they were performed on human beings previously unused to alcohol. After a short period of training they became immunised to the deleterious effect of their alcoholic diet. In the early stages the alcohol seemed to cause an increased excretion of nitrogen, probably due to its action as a protoplasmic poison. Following this, a proteid-sparing effect was produced, equal to that of the fat or carbohydrate, which the alcohol

replaced in the dietary. This economy of nitrogenous waste was, however, concurrent with an abnormal qualitative change in nitrogen distribution among the excreted materials, the main result being an increase in uric acid and certain purin bodies. This is suggestive of impaired oxidative powers in the liver, and possibly of similar processes in other parts of the body; it, moreover, suggests the harmfulness of even moderate indulgence in alcohol, and the need of reflection before we class alcohol as a food in the widest sense of the word.

The Ventilation of Sewers.—One might have supposed that any reference to this subject would be unnecessary, but the constant reiteration of complaints as to the discharge of foul exhalations from gratings in public roads and irresponsible generalisations as to their effect upon the public health, demand a brief review of the facts. A careful examination of all the points suggests the following conclusions: That while there is clear evidence of the production by sewer air of sore throat, gastro-intestinal disturbances and indefinite forms of ill-health, there is no recent evidence to show that such specific diseases as diphtheria or enteric fever are caused by its inhalation, but, on the contrary, in such diseases there is probably an entirely different cause. That the proper cleansing of drains and traps requires ample flushing water, probably much in excess of that commonly provided. That there is much evidence to show that sewer air runs along the crown of sewers, following no definite rule as to direction with or against the sewage currents, but tending to find its exit by openings at distances from its source and particularly at the dead ends on the main lines of sewers. That the movements or stagnation of sewer air depend, in the absence of artificial means of ventilation, on the temperature and humidity of the outer air and on the direction of prevailing winds. That the proper ventilation of drains or sewers and the prevention of nuisances, require sufficient fall to secure self-cleansing, sufficient flushing with water and free admission of air to the sewers. That it is necessary to ventilate not only the sewer, but all branches opening into it between the interceptor trap and the sewer.

With regard to the practical means to be taken to ventilate sewers, and at the same time prevent a nuisance, the solution of the problem lies in the adoption of a large number of reasonably-sized vent shafts rising from the crown of the sewer by a conical or bell-shaped enlargement, placed at frequent intervals, and provided with rust pockets. Further, that sewers must be regularly and frequently flushed, so that putrefactive matter may be removed before the

production of foul gases commences. Whenever possible, dead ends of sewers should be made to communicate with other sewers in the neighbourhood. The ventilation of sewers by gratings at the level of the road or street is both objectionable and dangerous, and the system is not made the less unsatisfactory by the practice of sprinkling these openings with a strong-smelling disinfectant. Recently, an agitation has been started to solve this question of sewer ventilation, by advocating the abolition of the intercepting trap on the house drain between the sewer and the house, thereby converting every house drain and the soil-pipes discharging thereto into so many sewer ventilators. The main objection to this proposal is that it would destroy the drain isolation, which is now possible, of each house from the rest of the houses of a district. Moreover, as we cannot rely absolutely upon the soundness of every sanitary fitting in individual houses, the risks of sewer air, possibly infected with specific disease germs, gaining direct access into dwellings would be considerable. It is to be hoped that no encouragement will be given to the putting into practice of this retrogressive suggestion.

Shell-fish and the Pollution of Tidal Waters.—This question has been very prominently before the public during the past year, mainly on account of the incidence of enteric fever which followed the ingestion of oysters at certain municipal banquets at the end of 1903, and on account of the prominence given to the subject in the fourth Report of the Royal Commission on Sewage Disposal. The epidemiological evidence is overwhelming as to the causation of enteric fever and enteritis by the consumption of contaminated shell-fish, that is, oysters and other shell-fish fattened and reared in estuarial or other waters receiving sewage. The results of bacteriology as applied to the examination of shell-fish are lamentably unsatisfactory, and amount practically to a confession that topographical observations as to whether any laying or pond is or is not to be considered as free from risk of objectionable contamination are just as valuable, if not more so, than the most precise bacteriological technique in a laboratory. The remedies clearly include (*a*) purification of all sewage before discharge into estuarial or tidal waters; (*b*) seizure and destruction of unwholesome shell-fish exposed for sale; (*c*) the provision of some competent authority to control and protect from pollution all fisheries, beds, pits, ponds and layings for shell-fish.

As regards the first remedy, we know that effluents from sewage farms and biological installations contain large numbers of bacteria,

many of them apparently of intestinal origin, and, in the light of recent experiments in which *B. pyocyaneus*, when added to sewage, was found to pass freely through septic tanks, contact beds and continuous filter, we must recognise that at present the treatment of sewage cannot be relied on so to alter its character as to allow of its discharge in the immediate vicinity of shell-fish layings, without incurring appreciable risk of disease resulting from the consumption of shell-fish taken from such layings. As to seizure of unwholesome shell-fish, it is doubtful whether the present state of the law permits such being done, certainly Section 116 of the Public Health Act, 1875, would be practically useless for the prevention of the sale of contaminated shell-fish. The only true remedy seems to be that recommended by the Sewage Commissioners, or the setting up of a special authority to control waters, layings and beds. If this is going to do any good, it is desirable that the power of this authority should be elastic, each river and estuary constituting a problem by itself. It may be anticipated that the formation of so-called River Boards, especially if endowed with power to control sewage access to foreshores and waters, to prohibit sale of shell-fish from unapproved layings or waters and to close oyster layings when open to pollution, would be a material protection to the public health and welfare.

The Ventilation Problem.—To those familar with the earlier history of sanitation in the Army, the prominent part which this question played, in efforts to improve the general well-being of the soldier, is well known. During the past year the question has come forward again, and although the point in dispute is really a question of ventilation of work places for factory operatives, the principles and facts involved are of paramount interest to ourselves. A Home Office Committee in 1897 suggested that not only in humified weaving sheds, but in all work places the maximum of carbon dioxide in the air should not exceed nine volumes in 10,000 of air, taken, of course, as an index of the organic impurity. The specimens of air were to be taken when no gas was burning, and therefore might be assumed to contain mainly the results of the respiration of workers. This standard was accepted by both employers and operatives, and has been in force for nearly seven years, with satisfactory results. In 1902 another Committee was appointed to consider the question again, and this year have recommended a maximum legal limit of twelve volumes by day and twenty volumes by night, with gas burning, for factories and workshops generally. This suggestion to lower the previous standard of

ventilation has led naturally to some criticism, and, in view of the notorious difficulties connected with practical ventilation, it is worth while considering what standard of quantity can be reasonably demanded in the air supply to confined spaces occupied by human beings. The answer evidently depends on the conclusions which we form as to what particular impurities or alterations in quality in air make it unwholesome. The particular impurities or alterations in quality which are generally associated with the effects of vitiated air on health, are poisonous or unpleasant gases and vapours, dust and bacteria, chemical and organic products of respiration, and impurities due to illumination. As to noxious gases and vapours, these should be dealt with at their point of origin and scarcely need consideration in connection with general ventilation. The case is different, however, in regard to dust, as of all impurities commonly present in air, none produce such well-defined deleterious effects as certain kinds of dust, particularly dust from the mechanical disintegration of hard minerals or metals, and poisonous dust such as that containing lead or arsenic. Another important variety of dust is that containing infective bacteria. There is only too much evidence to show that much of the extra disease associated with the aggregation of human beings is due to infective organisms inhaled as dust. Certainly in factories, and generally elsewhere, the prevention of evil effects produced by poisonous or infective dust can be secured effectively by other means than increased ventilation, especially by dealing with it in various ways at its point of origin. The logical conclusion in respect of this matter is that any standard of ventilation will depend largely on the harmfulness of the dust. It is regrettable that we are still very ignorant as to the relation between the cubic space or floor space per person, the ventilation as indicated by the proportion of carbon dioxide, and the general risks of direct air-borne infection from man to man.

The case of ordinary rooms and other closed spaces vitiated by the presence of persons and artificial lights, but not by other special causes, is more difficult, owing to the unsatisfactory evidence as to the nature of the vitiation. What evidence there is is associated with an increased percentage of carbonic acid, a corresponding diminution of oxygen, and the presence of organic respiration products. Experimental facts as to the physiological effects of an excess of carbonic acid and of a deficiency of oxygen in the air of confined spaces, point to the conclusion that they can have not the slightest ill-effect. This assertion is, I know, inconsistent with some of the traditions which are handed down from text-book to text-book,

but in view of the experimental evidence which shows that carbon dioxide, even to the extent of fifty volumes per 10,000, is harmless, I do not think it can be avoided. The same as to what are called organic respiration products; the evidence as to the existence of a volatile organic poison in respired air is so conflicting as to be really worthless. The only definite facts as to effects produced by volatile substances in badly-ventilated rooms are, that such air has an unpleasant smell and causes discomfort to many people, and the statistical evidence that mortality and disease are rife in badly-ventilated places, and that immediate improvement in health follows the introduction of efficient ventilation.

Looking at all the evidence as to the influence of vitiated air on health and comfort, I cannot but think we have disregarded too long the factors of the temperature of the air and its motion. It is a matter of common knowledge that warmth aggravates very greatly the effects of the smell, and that warm, stagnant, moist air is liable to cause faintness, apart altogether from any smell; on the other hand, cool moving air produces a marked and favourable influence on health. The remedy is clearly to ventilate sufficiently at least to prevent the air from becoming stagnant and smelling unpleasantly, and the more fresh air and floor space per person we can get in addition, the smaller we make the risks of infection. What, then, is to be our standard? The only practicable standard is that based on the proportion of carbonic acid in the air, and this, as reasonably attainable by proper methods and at not too great a cost, may be put at 10 volumes in 10,000 of air. In this sense, the suggested lowering of the ventilation standard in factories or elsewhere is much to be deprecated. At the same time we must remember that many of the bad effects of vitiated air due to specific causes can be dealt with largely and effectively one by one in other ways than by increasing indefinitely the supply of fresh air. Thus, we can prevent the escape into the air of noxious gases and dust, also prevent the dissemination of infective micro-organisms by a closer attention to personal and general cleanliness. Further, under certain circumstances, where the risks of personal infection are great, we ought to increase the ventilation or floor space allowance beyond any standards we may deem permissible under more ordinary conditions.

Air-borne Infection.—The number of infectious diseases that appear to be air-borne is considerable; the more prominent of these are small-pox, typhus, influenza and tuberculosis; while among those which seem to have a limited transit through air are

scarlet fever, measles, whooping cough, enteric fever and diphtheria. In any investigation of air-borne infection the problem must be considered from two points of view, namely, the part played by the donor of infection, and that played by the recipient. Now the first question which arises is, what are the chief ways in which an infective virus gains access to the air? As a source of infection in air-borne disease excretal pollution has been deemed, hitherto, as quite subsidiary; on the other hand, the mouth has been considered the main outlet by which morbific material gains access to the air. The obvious means by which infective matter is expelled from the mouth are by the expectoration and by the convection of droplets of mucus from the mouth during various expiratory acts. The work of Flügge, Laschtschenko, Heymann and others in this direction is well known. As the outcome of experiments on these lines it has been well substantiated that not only in the acts of coughing and sneezing, but also in the act of loud speaking, fine droplets of mucus are sprayed from the mouth into the air, and, moreover, may be wafted by air currents to considerable distances. Thus it has been shown that by reading aloud *B. prodigiosus* may be disseminated from the mouth to a distance of 8 yards. Other experiments with persons suffering from phthisis indicate that virulent tubercle bacilli may be emitted by coughing to a distance of 5 feet. Viewing the problem of air-borne infection from the point of view of the recipient, similar experiments show that animals exposed to infection within the dangerous zone consistently contract disease. That this conception of air-borne risk is not far fetched is emphasised if we remember that a normal adult inhales at least 10 cubic metres (34·5 c. ft.) of air daily.

In estimating the fouling of the air in dwelling-rooms, directly referable to emanations from the bodies of persons present in them, chemical reactions have been utilised mainly. In the light of the foregoing considerations some measure of determining the quantity and quality of particulate matter of possibly deleterious nature which has been shed into the air of occupied rooms by persons, is eminently desirable. With a view to solving this question some work of Gordon's is interesting (*Supp. to* 32*nd Rep. Local Gov. Board*, p. 421). His first task was to determine the bacterial fauna of normal saliva. From samples collected from twenty-five normal persons it was found that the characteristic organisms present in all cases were streptococci, and that the numbers of those organisms present varied from ten to a hundred millions per cubic centimetre. From the abundance and constancy of its presence,

Streptococcus brevis was selected as the most suitable for diagnostic purposes: from one ten-millionth to one hundred-millionth part of a cubic centimetre of saliva was found sufficient to demonstrate the presence of this organism. Its presence is readily detected by virtue of its producing a definite change of colour in neutral-red broth incubated anaerobically at 37° C. for forty-eight hours. By distributing culture media of this nature about rooms in which persons were speaking and breathing, Gordon was able to obtain definite evidence from the air of the presence in it of normal contents of human saliva. The translation of salivary particles was manifest at a distance of 40 feet in front and 12 feet behind speakers. Experiments made to show the aerial contamination associated with silence and with ordinary quiet conversation failed to indicate the dissemination of salivary droplets. Within certain limits it is possible that this streptococcal index may prove a more direct and valuable gauge of air contamination by the human subject than those tests of mere gaseous impurity which hitherto have been so much relied on.

Physical Deterioration.—No retrospect of the last year would be complete without a reference to this subject, which has rightly excited very considerable interest not only in our own profession but among laymen. The fact, pointed out originally by Sir F. Maurice, that 60 per cent. of the men joining the Army had within two years to be rejected as unfit, first directed attention to this matter, and led naturally to the desire to ascertain the cause of this unfitness, not only on account of the Army, but of the larger question that, if so many men are unfit to serve as soldiers, what is to become of them as mere citizens. That this wider view of the matter has been conceived is, I think, one of the most gratifying features of the whole discussion, though it has been marred by injudicious statements that the population of this country has undergone physical deterioration as compared with past time. On this subject there is practically no evidence, for there are no statistics as to the physique of either the present generation or of past generations. To be on safe ground, we must take a broad view of the health conditions of the people as we know them at the present time, and compare them with those of some former period. In the present day the proportion of town dwellers in the total population is 77 per cent., whereas forty years ago it was only 63 per cent.; further, the census returns indicate that in the course of these forty years the rural population has varied little in numbers, whilst the urban population has nearly doubled itself. The higher death-rates in urban districts, the lower mean

duration of life and the greater prevalence of certain diseases, indicate that the conditions of life in urban areas are less favourable to health, longevity, and active work than the conditions of rural life. Owing to the steady migration from the country districts into the towns, a larger proportion of the whole population is coming under these adverse conditions, and though their effect may not be very marked upon the original emigrant from the country, their effect upon his descendants is likely to be more so. On the other hand, we must remember that the conditions of urban life are steadily improving, so much so that, compared with forty years ago, our present town dwellers are probably healthier and physically stronger than the corresponding class was at that period. The improvement is likely to continue. It seems to me futile to hope for any great migration from the towns to the land; our efforts to counterbalance the evils that follow the modern tendency for more and more people to live in towns must be directed essentially to increase the health and well-being of these town dwellers, but it is questionable whether even the best and most enlightened of such efforts will preserve among a nation of town dwellers the qualities and characteristics of a race of agriculturists.

What, then, is the remedy? Clearly to encourage increasing effort to raise the general health of those who live in towns, and among the questions that have to be faced are those of overcrowding, faulty dieting, and the evil effects of drink; but these are really of secondary importance as compared with efforts to check the evils caused by the neglect of mothers, the improper feeding of infants, and the non-hygienic control of education. A limit would seem to have been reached in the matter of municipal effort to prevent overcrowding, by demolishing insanitary areas and providing model dwellings for the working classes; it is true there is still more to be done, but very much more remains to be done to render school life more healthy by the exercise of some wisdom in the control of education. Masses of children are forced into school and to plod, day after day, at subjects which will be of no practical use to them when they have to begin the serious work of life. How many, too, of these children are hungry, unwisely clothed, and suffering from affections of the eyes, ears, nose, or throat? Then, also, those who are fit or unfit are made often to go through unsuitable physical exercises, the delicate and the robust doing exactly the same for the same length of time. These are defects in our national system of education which must have a far-reaching effect upon the physical fitness of the next generation; they can be remedied only by the

provision of intelligent medical supervision in all schools. This supervision needs also to furnish reliable data as to the state of all those children who are compulsorily educated; in a few years figures could be collected by which a fair estimate might be formed of the real physical condition of present day children and, by means of a later series of figures, facts obtained either for or against the view that progressive deterioration exists. Without data of this nature we are not in a position to know. Apart from these reforms in school life and methods looms the paramount need of a closer sanitary control of the country's milk supply, and the inculcation among the masses of sound ideas as to the feeding of infants. This question of proper infant feeding lies at the root of the unfitness which exists undoubtedly in the ranks from which our recruits are drawn. Knowing the extent to which mother's milk is replaced by cow's milk in the feeding of infants, and knowing, as we do, the condition in which cow's milk reaches the homes of the poor, can we be surprised at the great infant mortality, and at the unfitness of the majority of the survivors? Without clean milk there will always be continued loss of young life and unfitness, and without medical supervision of all elementary schools and the collection of statistics there will be no certain evidence to prove physical deterioration. The satisfactory solution of this great national problem depends largely upon the realisation of these principles.

A FEW NOTES ON ENTERIC FEVER.

By Major J. S. EDYE.
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Captain E. A. Bourke's notes on seventy-five cases of enteric fever in India, in the Journal of the Royal Army Medical Corps for September, 1904, and in which he eulogises the value of carbolic acid, leads me to think of two series of cases of my own—the one in Africa, the other in Bermuda—which may interest your readers.

Many years ago, in India, I was much impressed with the earnestness with which an apothecary—as they were then called—spoke to me of the value of carbolic acid in the disease, and in the result of the few trials I gave this drug; and subsequently by the articles of Colonel Quill, R.A.M.C.

In the Transvaal, in 1901, I was in charge of the enteric section of a large general hospital, and for four months I had 150 beds constantly full of undoubted cases of enteric fever. Great care was taken upon the arrival—usually twice weekly—of a large batch of sick, only to pass into these twenty-five marquees undoubted cases of enteric fever, and at this selection I had the assistance of a very able civil surgeon of Johannesburg; and upon the following day, and also twice weekly, the Principal Medical Officer and myself again very carefully went over the cases, in order that we might eliminate any doubtful case.

The following five tables will briefly show the results of four lines of treatment employed.

With reference to the only fatal case in the first series, Private J. F., he was a most intelligent man, and I obtained a distinct history of ailing only six days before admission; and his temperature had been normal for some twenty-five hours before his sudden death, about 8 a.m. On the evening before his death he had stated to the Sister "he never felt so well since he arrived in hospital" (six or seven days previously), "and was going to ask the doctor if he could get up." He had a good night, and was laughing and chatting the next morning, his temperature was normal, and he was propped up in bed for the orderly to sponge over his face, &c., when he put his hand to his chest, complained of pain, gave a few gasps, and fell back dead.

Here we have a distinct history of at most thirteen days' illness up to date of death, the temperature having been normal for twenty-

TABLE I.—THE CARBOLIC ACID AND IODINE TREATMENT IN NINETEEN CASES.

Number of marquee	Rank and name	Corps	Age	Inoculated	Diarrhœa	Number of days ailing before admission	Number of days before temperature normal, calculated from date of coming under treatment	Number of days before temperature normal, morning and evening, from date of coming under treatment	Relapse	Result	Remarks
There were 25 marquees, and these cases were in Nos. 1 to 10 Marquees, inclusive	Private W. S.	R.A.M.C.	28	Yes	Yes	5	14	14	No	R.	—
	Trooper G. M.	I.L.H.	33	No	No	14	5	9	For 2 days	,,	—
	Corporal R.	I. Bushman	27	,,	Yes	9	7	18	No	,,	Debility great.
	Private W. C.	E. Surrey Regt.	30	,,	No	21	3	13	,,	,,	—
	Trooper T. R.	I.L.H.	23	,,	,,	30	15	18	,,	,,	Reported dangerously ill.
	,, S. M.	,,	30	,,	,,	60	11	12	,,	,,	Desperately ill.
	,, A. P.	,,	20	Yes	,,	10	11	13	,,	,,	—
	Driver W. R.	R.F.A.	30	No	,,	7	11	14	,,	,,	Attacks of syncope frequently.
	Private W. N.	Somerset L.I.	28	,,	,,	10	10	19	,,	,,	—
	Sergeant E. S.	Devon Regt.	34	,,	,,	4	11	14	,,	,,	Reported dangerously ill.
	Private S. M.	Cheshire Regt.	27	,,	,,	7	15	15	,,	,,	,, ,, ,,
	Trooper T. B.	I. Bushman	24	,,	,,	8	13	17	,,	,,	—
	Private A. U.	Derby Regt.	32	,,	,,	20	3 and 16	18	Yes	,,	Hæmorrhages. Reported dangerously ill.
	,, J. F.	14th Hussars	21	,,	,,	6	6	7	No	Died	*Post mortem.* See below.
	Corporal T. W.	Border Regt.	29	,,	,,	6	5	5	Yes, for 10 days	R.	—
	Trooper J. H.	A.S.C.	19	,,	,,	7	6	12	No	,,	—
	Private F. S.	Somerset L.I.	23	,,	,,	7	20	21	,,	,,	Reported dangerously ill.
	,, F. C.	12th Lancers	33	,,	,,	5	10	14	,,	,,	—
	,, J. M.	Somerset L.I.	20	,,	,,	5	17	18	,,	,,	—

five hours previous to death, and mark the *post-mortem* signs three hours later. All the organs were examined and were normal. Upon slitting up the right pulmonary artery I soon came to a large fresh clot, extending into the vessel and its ramifications; the clot in places was beginning to get decolourised. The smaller ramifications of the left pulmonary artery contained a dark clot. The small intestine showed congestion over its lower five feet, most intense towards the valve, and scattered throughout these five feet were swollen and congested Peyer's patches, some granular and about to break down, and one a typical enteric ulcer. A few of the solitary glands of the large gut were swollen, and the stomach was congested.

Now here is a proven case of enteric fever, with a normal temperature for the whole of the seventh day he was under treatment, and a clear history of only six days' prior ailing; but many would say—had the man recovered—"Oh, it could not have been a case of enteric fever"; and it only corroborates what I have before said, that these apparently trivial cases of continued fever, *with* the other symptoms of enteric fever, well or slightly marked, when they do die from any accidental cause, invariably show *post mortem* typical enteric lesions. At the same time, I unhesitatingly say there is a continued malarial fever, such as one sees especially in the Punjab, Hong Kong, and other parts of the world, but then you have few, if any, of the symptoms typical of enteric fever. I would like here to say that it was noticeable under the carbolic acid treatment that, though the temperature fell early, thereby greatly husbanding the patient's strength, the tongue often remained foul, with red tip and edges, or even dry or brown, for some days or weeks after the temperature became normal, and had not the patient been mercilessly kept on slops—though plenty of them—for two or three weeks after the temperature was normal, I should have had relapses and trouble. Quinine, 5 grs., was given, usually at 2 p.m. daily, to check the evening rise of temperature and counteract any malarial tendency, and as an antiseptic. Three or four doses of turpentine in 10-minim doses, and as stupes, were invaluable for tympanites; and the ice-bag to the iliac fossa, with 10 grs. of gallic acid, in hæmorrhage, two doses being usually sufficient of the gallic acid.

In two cases slight congestion of the lungs threatened, but turpentine liniment rubbed into the back, with creosote inhalations, and omitting the carbolic acid treatment and giving alternately a dose of ammon. carb., with cinchona bark, and a mixture of digitalis and iron for forty-eight hours, was productive of the best results. There was no carboluria.

Private F. S., Somerset L.I., was at one time in such a desperate condition that strychnine and iron were given for forty-eight hours. Phenacetin was occasionally given for very severe headache, but the patients were always sponged all over at least once a day, and I had splendid nursing.

The routine treatment was a 4-grain calomel powder upon admission, and

℞. Acidi carbolic	.. .. ..	♏i.
Tr. iodidii ..	.. .. ..	♏iv.
Syrupus aurantii ..	.. ..	ʒi.
Aqua	.. .. .. ad	℥i.
Sig. One ounce thrice daily.		

Hence, with the quinine, a patient received four doses of an antiseptic in the day, and the stomach was allowed to rest through the night, except for any nourishment. In using iodine one need not use such large doses of carbolic acid, and you do away with the objections to that drug; and the use of iodine, besides being tonic in its action, is well known as a stimulant to ulcers on the surface of the body, and I did not find that it caused vomiting in any one of these cases.

My special contention is that, when the case is obtained early, this line of treatment very frequently causes it to abort. For diarrhœa a dose of sulphuric acid and opium, followed by a lead and opium pill, rarely failed. The ice-cap and spinal ice-bag were occasionally used, and insomnia was met with 20 grs. of sulphonal.

Constipation continuing after the first dose of calomel was met by enemata, and the diet was fairly generous, consisting of milk and barley water, with Brand's essence, and some brandy and beaten-up eggs gradually added; occasionally champagne was used.

Eighteen Cases of Enteric Fever Treated with the Perchloride of Iron.

Some time ago I read one or two articles in the *British Medical Journal* on this line of treatment in the disease, and with one of these articles I was much impressed, so I determined to place some of my cases on this drug and watch events. They were dotted about in the marquees with the other enteric fever patients, and were treated during the same period, and in every way were under the same conditions of food and nursing, and they all had calomel upon admission, and were sponged daily. Fifteen minims of tr. ferri perchlor. was given with sp. chloroform thrice daily.

Six or eight of these cases complained of pain and tenderness in the epigastrium after a few days—some gastritis, I presumed—and I more or less had to intermit or omit the treatment.

TABLE II.

Marquee	Rank and name	Corps	Age	Inoculated	Diarrhœa	Number of days ailing before admission	Number of days before temperature normal, calculated from date of coming under treatment	Number of days before temperature normal, morning and evening, from date of coming under treatment	Relapse	Result	Remarks
Nos. 1 to 10	Private D. McL.	Imp. Yeomanry..	34	No	Yes	5	20	25	No	R.	Very seriously ill.
	Corporal W. B.	,, ,, ..	23	,,	No	11	13	17	,,	,,	—
	Trooper H. P...	Roberts's Horse ..	18	,,	,,	5	6	10	,,	,,	Tongue bad for some time, weak and emaciated.
	Private A. M...	E. Surrey Regt...	20	,,	,,	4	8	16	,,	,,	—
	Trooper J. T. ..	Scottish Horse ..	21	Yes	,,	2	16	17	,,	,,	—
	Corporal H. G..	Worcester Regt...	23	No	,,	4	13	15	Yes, for 2 days	,,	Phlebitis.
	,, D. J..	1st R. Welsh Regt.	22	,,	,,	8	26	30	No	,,	Phlebitis, both legs; dangerously ill; high temperatures.
	Trooper J. B. ..	N. Zealand Contgt.	24	Yes	Yes	9	6	16	,,	,,	—
	Private H. B...	10th Hussars ..	32	No	No	10	15	17	,,	,,	—
	Trooper H. M..	S.A. Constabulary	30	,,	,,	8	6	13	,,	,,	Very ill on arrival; tongue bad for some time
	Private H. W..	19th Hussars ..	20	,,	Yes	8	10	16	,,	,,	Reported dangerously ill.
	,, A. B. ..	A.S.C.	25	,,	No	8	12	16	,,	,,	High temperatures.
	,, A. A. ..	1st Suffolk Regt.	22	,,	,,	14	14	22	,,	,,	Hæmorrhage from bowels, reported dangerously ill.
	,, G. K...	K.R.R...	20	,,	,,	6	5	16	Yes	,,	Very seriously ill; bad tongue for some time.
	Trooper G. D...	S.A. Constabulary	20	Yes	Yes	3	16	17	No	,,	—
	,, W. W..	K.R.R.	28	No	No	10	9	13	Yes	,,	Dyspepsia.
	,, R. McA.	,, ...	29	,,	,,	5	13	16	,,	,,	—
	,, T. H...	K.S.L.I.	26	,,	,,	7	4	10	No	,,	Tongue bad for some time.

TABLE III.

Marquee	Rank and name	Corps	Age	Inoculated	Diarrhœa	Number of days ailing before admission	Number of days before temperature normal, calculated from date of coming under treatment	Number of days before temperature normal, morning and evening, from date of coming under treatment	Relapses (after temperature had become normal, morning and evening)	Result	Remarks
Nos. 1 to 10	Private W. W.	6th Dragoon Grds.	27	No	Yes	21	14	32	No	R.	After ten days treatment stopped, because of a scalding pain on micturition, when temperature began to rise. After seven days of no medicine he recommenced the turpentine.
	Trooper S. A. ..	S.A. Constabulary	23	,,	,,	10	20	34	,,	,,	Dangerously ill; delirious.
	Private W. B. ..	K.R.R.	20	,,	No	8	6	13	,,	,,	Tongue bad for some time.
	,, R. G. ..	13th Hussars ..	27	,,	,,	10	7	13	Yes	,,	—
	,, M. B. ..	1st Welsh Regt. ..	20	Yes	Yes	6	6	7	,,	,,	Dangerously ill, and high temperature during the relapse.
	Corporal A. D. .	12th Lancers ..	23	No	No	5	6	9	,,	,,	—
	Private C. S. ..	K.R.R. ..	21	,,	,,	8	23	26	No	,,	High temperature; hæmorrhage from bowels; reported dangerously ill.
	,, A. B. ..	2nd Somerset L.I.	22	,,	,,	6	16	18	,,	,,	Tongue bad for some time.
	Trooper W. C. .	S.A. Constabulary	20	,,	Yes	21	On 10th day of illness pneumonia, and treatment changed			Died	Dangerously ill; delirious.
	,, F. J. ..	,, ,,	21	,,	,,	5	22nd day after admittance temperature not normal, and I left			—	Dangerously ill; delirium.

Ten Cases of Enteric Fever Treated with Turpentine.

These cases were dotted about in the same marquees and at the same time as those cases on the carbolic acid-iodine treatment, and the iron treatment, and came under the same conditions of food and nursing. Calomel was given upon admission, and any symptoms, such as diarrhœa, were combated in the same way as mentioned in the early part of this article. Ten minims of turpentine were given in mucilage and peppermint water thrice daily for seven days, and then twice daily.

In the marquees Nos. 1 to 10 there were four or five cases of phlebitis, I remember, towards the latter end of the four months during which time I was making these notes, and I remember they all occurred within a few days of each other, two being in contiguous beds. I mention this on account of the apparent impossibility of infection or contagion, and yet it has frequently been noticed that, given one case of phlebitis, others will occur.

The Chlorine Treatment.

I now bring to notice some cases which were treated by mistura chlorine and quinine. A few were under my own personal care, and I was responsible for all the others, they being in Nos. 11 to 25 marquees, and under the immediate care of a very able medical officer. I regret I only have brief notes of these cases, but such as they are I have set them down.

Where the columns are blank I have not the particular record tc insert, but they arrived twice weekly as the others did, and during the same period, and were in no way selected, being distributed as the others were to any one of the marquees 11 to 25, in the square occupied by marquees 1 to 25, and they had the same advantages of food and day and night nursing, all of which was as good as possibly could be.

Camp of the Prisoners of War (Bermuda).

There were seven isolated islands, more or less cleared of brushwood, and an encampment was formed of some 5,000 prisoners here, guarded by the Royal Warwickshire Regiment, all old soldiers, and the survival of the fittest from South Africa. The hospital was on one island, and all sick prisoners were sent to it, and there were a certain number of cases of enteric fever; but the sick of the Royal Warwickshire Regiment were sent to a permanent hospital on one

TABLE IV.—TWENTY-NINE CASES OF ENTERIC FEVER TREATED BY MISTURA CHLORINE (BURNEY YEO TREATMENT).

Marquee	Rank and name	Corps	Age	Inoculated	Diarrhœa	Number of days ailing before admission	Number of days before temperature normal, calculated from date of coming under treatment	Number of days before temperature normal, morning and evening, from date of coming under treatment	Relapses (after temperature normal, morning and evening)	Result	Remarks
Nos. 11 to 25	Private S. ..	No record	No record	No record	No record	No record	17	21	No record	All recovered except two, who died between the 21st and 30th days after admission	Private Mullins, a patient to whom no treatment was given, recovered. The temperature first came to normal on the 35th day of his illness, and normal morning and evening on the 39th day.
	,, S. ..						28	28			
	Unknown ..						9	10			
	,, ..						10	11			
	,, ..						12	19			
	,, ..						13	21			
	,, ..						15	21			
	,, ..						17	24			
	,, ..						18	24			
	,, ..						20	24			
	,, ..						20	24			
	,, ..						22	27			
	,, ..						22	28			
	,, ..						24	28			
	,, ..						24	39			
	,, ..						28	41			
	,, ..						28	45			
	,, ..						33	45			
	Private C. ..						22	24			
	,, L. ..						12	19			
	,, B. ..						12	Unknown			
	,, S. ..						9	10			
	,, J. ..						22	24			
	,, B. ..						18	24			
	,, R. ..						10	11			
	,, T. ..						15	21			
	,, K. ..						24	41			
	,, McK. ..						20	27			
	,, R. ..						13	24			

TABLE V.—FORTY CASES OF ENTERIC FEVER IN THE WORCESTER REGIMENT AND ROYAL ENGINEERS AT BERMUDA, TREATED WITH CARBOLIC ACID AND IODINE.

Rank and name	Age	Number of days ailing before admission	Number of days before temperature normal, calculated from date of coming under treatment	Number of days before temperature normal, morning and evening, from date of coming under treatment	Re-lapse	Result	Remarks
Boy S.	16	3	12	14	No	R.	—
Sergeant R. ..	26	4	10	12	Yes	Died	—
Private T. ..	20	2	15	16	No	R.	—
,, E. ..	21	5	—	—	—	Died	—
,, S. ..	23	4	25	25	No	R.	—
Sergeant N. ..	30	5	16	26	,,	,,	—
Private A. ..	20	1	9	17	,,	,,	—
Corporal B. ..	20	7	16	19	,,	,,	—
Qmr.-Sergt. B.	35	3	10	14	,,	,,	A perfect wreck.
Sergeant W. ..	42	5	6	30	Yes	,,	,, ,,
Private M. ..	30	7	42	42	No	,,	—
Sergeant D. ..	21	12	8	15	,,	,,	—
Private B. ..	18	7	15	16	,,	,,	A perfect wreck.
Boy H.	16	12	9	12	,,	,,	—
Private Y. ..	23	6	9	11	,,	,,	—
,, P. ..	26	5	13	21	,,	,,	—
,, J. ..	31	2	9	11	,,	,,	—
,, M. ..	20	3	22	24	Yes	Died	—
,, V. ..	20	4	9	11	No	R.	—
,, F. ..	25	4	8	21	,,	,,	—
Sergeant M. ..	20	8	5	15	,,	,,	—
Private W. ..	25	4	12	20	Yes	,,	—
,, H. ..	20	4	4	15	No	,,	—
,, D. ..	23	3	12	12	,,	,,	—
Sapper W., R.E.	24	4	4	6	,,	,,	—
Private S. ..	19	3	10	11	,,	,,	—
Corporal G. ..	20	4	3	17	,,	,,	—
Sergeant K. ..	29	5	2	8	,,	,,	—
Sapper H., R.E.	21	7	—	—	—	Died	—
Private M. ..	26	2	9	27	Yes, twice	R.	—
,, W. ..	36	14	3	5	No	,,	—
Corporal M. ..	41	4	—	—	—	Died	—
Sapper K., R.E.	21	3	12	18	No	R.	—
,, B., ,,	24	4	5	20	,,	,,	Died of syncope, some time after being up and about, and having been transferred as a convalescent to another hospital.
Private S. ..	20	4	11	17	,,	,,	—
,, J. ..	20	14	9	9	,,	,,	—
Boy R... ..	16	3	14	15	,,	,,	—
Sapper J., R.E.	23	2	17	19	,,	,,	—
Private W. ..	22	3	12	12	,,	,,	—
,, M. ..	29	2	2	11	,,	,,	—

of the permanently occupied islands, where chiefly Royal Engineer and Royal Artillery troops were quartered. I believe I am right in saying there was not one single case of enteric fever amongst them. But after about a year the Worcestershire Regiment from Malta relieved the Royal Warwickshire Regiment, and forthwith enteric appeared amongst them, and about this time I was sent to the island in charge of the permanent brick and mortar hospital, and where the Royal Engineers and Royal Artillery were quartered. There were sixty-two beds (with rarely one empty), but forty-four, I think, on paper, a marquee being in use.

There was a hospital staff numbering six to eight, three or four of whom were fairly reliable, and even two of these absented themselves for five days when they were paid their "war gratuity," and this, too, in the middle of the epidemic. Towards the end of the epidemic another medical officer arrived.

I had, however, all the food and drugs I wanted, and I lived only about 300 yards off—that is to say, I only had to go about this distance for my meals and to sleep, for I rarely left the hospital during the epidemic, except for seven or eight hours each night. I append a similar table on page 311 to those given on the former pages. The cases were treated as the first series were, viz., by carbolic acid and iodine.

After about half these cases had been admitted, the General Officer Commanding took the whole regiment off the Prison Islands, and placed them under canvas on the Royal Engineers' and Royal Artillery's Island. The Royal Artillery were a long way off, but the Royal Engineers were close to the camp. Note how the Royal Engineers became at once infected, proving the disease to have been enteric fever. The last case to report sick occurred twenty-four days after the arrival of the whole regiment under canvas.

ON A MODIFICATION OF WRIGHT'S METHOD FOR COUNTING THE BACTERIA CONTAINED IN A CULTURE.

By Captain W. S. HARRISON.
Royal Army Medical Corps.

In all work in connection with bacterial vaccines the necessity for an accurate method of standardising the cultures used is paramount. In a recent investigation, in which the writer took a part, the inadequacy of the methods which are at present in vogue was brought forcibly to mind and he was, in consequence, induced to attempt to devise a method which would give more uniform and accurate results than the present processes do.

Wright[1] has described a method which depends on the proportion existing between blood-cells and bacteria in a mixture of definite volumes of blood and culture; he aims at obtaining by this means a precise numerical expression of the bacteria, both living and dead, present in a volume of the culture. Unfortunately, in actual practice, the process gives very variable results, and, even in the hands of its author, it gives figures with a variation of as much as 22 per cent. above and below the average of two counts. These unsatisfactory results are due, I believe, in part to the difficulty of thoroughly mixing the blood and culture; to the influence of the blood fluids in producing agglutination of the bacteria, and possibly bacteriolysis during the process of mixing; to uneven distribution of the blood-cells and bacteria during the spreading of the film; and lastly, to the fact that, during the process of fixing and staining, a proportion of the bacteria are washed away while the more bulky red cells remain. Very probably the last two factors are the chief ones which conduce to fallacy, and especially the last; it happens not infrequently that one gets a lower reading by this method than one gets from enumeration of the colonies on an agar culture, and in the results quoted below, it will be seen that three counts made by Wright's method gave much lower results than those given by the method about to be described.

It seemed, however, that it was possible to overcome these causes of error, and the process described below is the result of attempts in this direction. Briefly, the method consists in:

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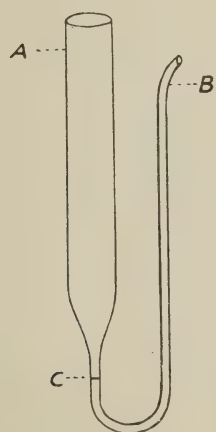
[1] *Lancet*, July 5th, 1902.

(1) Preparing a suspension of the cells of a definite volume of blood in a similar fluid to that in which the bacteria to be counted are suspended; (2) mixing the suspension of blood-cells with a convenient number of volumes of the culture, the bacteria of which have been previously stained in bulk; (3) placing a sample of the mixture under a cover-glass and luting the specimen with vaseline; (4) counting the red cells and bacteria in the specimen, field by field, and calculating the bacterial content of the culture from the figures thus obtained. By these means one avoids all fallacies due to the action of the blood fluids, which have been removed during the process of preparing the suspension of blood-cells; one gets an even mixture, the red cells and bacteria are evenly distributed in the specimen, and are not further interfered with, so that there is



Rough sketch of the pipette used for the suspension of blood-cells. Natural size.

no risk of losing bacteria during processes of fixing and staining. The details of the *technique* employed are as follows, the whole of the processes being done in duplicate:—

The Preparation of the Suspension of Blood Cells.—The red cells of the blood to be used having been counted in the usual way, a stout capillary pipette, such as is used in sedimentation tests, is taken and bent, at a point about half an inch below the commencement of the capillary portion, into the form of a long narrow U, as shown in the accompanying rough sketch; the terminal quarter of an inch of the capillary portion of the pipette is bent over to one side so as to form an angle of 120° or thereabouts with the

remainder of the tube; a mark is made on the tube at the point (C). The tube is filled by dipping the point (B) into the drop of blood resulting from a prick in the observer's finger, the blood is allowed to run along the pipette to the mark (C), the end of the pipette is rapidly wiped and then inserted into a 0·75 per cent. solution of citrate of soda in normal saline solution, the fluid is allowed to run along the pipette, washing the blood before it, until the chamber (A) of the pipette is about half filled; the apparatus is then placed in a centrifuge and the blood-cells driven down into the bend of the U, the supernatent clear fluid is removed and the pipette refilled in the same manner as before, this time with broth or normal saline solution, according to the fluid in which the bacteria to be estimated are suspended ; the mixture is again centrifuged and the supernatent fluid again removed; the operation is repeated; thus making a total of three washings of the blood-cells, and leaving them suspended in a fluid of the same kind as the fluid in which the bacteria is suspended. After the last washing the bulk of the fluid is brought to the same volume as the original quantity of blood taken as indicated by the mark on the pipette, by removal of the supernatent clear fluid. No blood-cells are lost in the process of washing and the pipette retains its original form and size, and remains available for measuring the volumes of culture which are to be added to the blood-cell suspension at a later stage of the proceedings. There are one or two minor details in the manipulation of the little tube which it may be useful to mention. When one removes the supernatent fluid from the chamber of the pipette the fluid will be found to recede from the capillary end and the resulting cushion of air effectually prevents the refilling of the pipette; the difficulty is easily overcome by pressure with the tip of a finger over the end of the chamber. Another point is that the larger end of the tube should be placed towards the outer side of the cup of the centrifuge, otherwise, when the centrifuge is slowing down and the cups are approaching the vertical position, the heavy end tends to bend towards the periphery of the circle described by the centrifuge and the tube snaps; the point is a trifling one, but well worth attention if one wishes to save one's self annoyance.

The Staining of the Bacterial Culture.—The culture having been thoroughly mixed by vigorous shaking, nine volumes of it are mixed with one volume of a 1 per cent. solution of methylene blue (in the case of a thick emulsion it is better to dilute it to 1 in 10 and then treat it in the same way as a broth culture). The culture and dye are thoroughly mixed, sealed off in a pipette and placed in a water-

bath at 45° C., the temperature of the bath is raised to 60° C., and kept at that level for fifteen minutes; the temperature must be kept constant and must not be exceeded, else there is a tendency for the dye to form large blocks of deposit which spoil the specimen.

The Preparation of the Specimens for Counting.—A number of clean watch-glasses, slides and cover-glasses having been laid ready, the stained culture is blown out into a watch-glass and thoroughly mixed, a preliminary inspection of the culture is made under a one-twelfth objective in order to get a general idea of the number of bacteria present and of the number of volumes of the culture which it will be convenient to mix with the suspension of blood-cells. The blood-cell suspension is then blown out into a clean watch-glass, the cell remaining in the pipette being washed out into the watch-glass also, by means of one or two volumes of broth, then a convenient number of volumes of the stained culture are taken up in the same pipette and mixed with the blood-cells, each volume of the culture being of the same volume as the original quantity of blood taken, as shown by the mark on the pipette; as a rule it will be found that ten volumes of culture, or of diluted agar emulsion, to one volume of blood-cell suspension will form the best mixture, both for counting and for the subsequent calculation. The blood-cells and bacteria must be very thoroughly mixed by drawing in and out of a pipette several times, as a matter of fact, three or four minutes is not too long a time to spend over the process. The mixture having been made, a small drop from the pipette is placed on a slide and immediately covered with a cover-glass, the size of the drop being that which will just suffice to cover the whole space under the cover-glass without putting any pressure on it. The specimen is immediately luted with vaseline and is then ready for counting; it is as well to make two or three such specimens in order to have a selection from which to take the best spread one to count. In the whole of this process rapidity of working is essential, otherwise the blood-cells will settle in the mixture and the count be spoiled, hence the necessity of having everything ready before beginning the mixing operation.

The Counting of the Specimen and Subsequent Calculation.—The preparation is examined under a one-twelfth objective, the diaphragm of the microscope being half closed, and it is a convenience to restrict the field by means of a counting disc, a cover-glass marked with a square of about a quarter of an inch, which is dropped into the eye-piece. Having satisfied himself that the specimen is properly made, one proceeds to count it, taking field by field, and noting in each the

number of red cells and of bacteria present; the latter will be found to lie in different planes and, especially if the specimen is a little thick, some of them will be seen to show Brownian movement, but by focussing and by taking advantage of the landmarks made by the distribution of the red cells, it will be found that the bacteria can be counted quite readily. About fifty fields should be counted, and they should be taken *seriatim* without any conscious or unconscious selection. The counting having been completed, the total numbers of red cells and of bacteria seen are added up and from the figures obtained the calculation of the bacterial content of the culture is made as follows:—

$$\begin{array}{c}\text{Number of red}\\ \text{cells counted}\end{array} : \begin{array}{c}\text{Number of red cells in}\\ \text{1 cc. of blood used}\end{array} :: \frac{\text{Number of bacteria counted}}{\text{Number of volumes of culture in mixture}} : \frac{9}{10} \begin{array}{c}\text{Number of}\\ \text{bacteria}\\ \text{in 1 cc. of}\\ \text{culture}\end{array}$$

The nine-tenths in the last figure of the proportion sum is, of course, due to the fact that the culture was diluted with one-tenth volume of dye before staining and a correction is necessary for this.

Results.—The following are the results of eight consecutive counts made by this method. The term "error" is used to denote the extent to which either of the figures obtained exceeds, or is less than, the average of the two counts.

(1) A broth culture of *B. typhosus.*

1st count = 320 millions per cc. 2nd count = 283·4 millions per cc.
Error = ± 6 per cent.

(2) A broth culture of *B. typhosus.*

1st count = 188·3 millions per cc. 2nd count = 237 millions per cc.
Error = ± 11·4 per cent.

(3) A broth culture of *B. typhosus.*

1st count = 246·3 millions per cc. 2nd count = 238·09 millions per cc.
Error = ± 1·69 per cent.

(4) A broth culture of *B. typhosus.* Two samples were tested, one of undiluted culture and the other of culture diluted with one-third broth.

Undiluted culture = 471·6 millions per cc. $\frac{2}{3}$ culture = 314·32 millions per cc.
(= 471·48 millions per cc. in the original.)
Error = negligible.

A living count made on agar plates gave 112 million bacteria per cc., the culture being four days' old.

A count of the same culture made by Wright's method gave:—

Undiluted culture = 243·2 millions per cc. $\frac{2}{3}$ culture = 223 millions per cc.

(5) A fairly thick emulsion in normal saline solution of a twenty-four hour agar growth of *B. typhosus.* In one count the emulsion was counted undiluted, in the second the emulsion had been diluted with 1 in 5 of normal saline solution.

Undiluted emulsion = 2,744 millions per cc. $\frac{4}{5}$ emulsion = 1,994·8 millions per cc.
(= 2,493·5 millions per cc. in the original.)
Error = $\pm$ 4·7 per cent.

A count of the same emulsion made on agar plates gave 2,066 millions per cc.

(6) A twenty-four hour broth culture of *B. typhosus.* The control used was the culture diluted with 1 in 5 of broth.

Undiluted culture = 183·9 millions per cc. $\frac{4}{5}$ culture = 166·6 millions per cc.
(= 208·25 millions per cc. in the original.)
Error = $\pm$ 6·2 per cent.

A count of the same culture made on agar plates gave 126 millions per cc. A count made by Wright's original method gave 63·4 millions per cc.

(7) An emulsion of a three days' agar culture of *B. typhosus.* One sample was diluted to 1 in 9 before staining.

1 in 10 diluted emulsion = 203·98 millions per cc.
(= 2,039·8 millions per cc. in the original.)
1 in 9 diluted emulsion = 218·52 millions per cc.
(= 1,966·68 millions per cc. in the original.)
Error = $\pm$ 1·8 per cent.

(8) A very thick emulsion of a twenty-four hour agar culture of *B. typhosus* in normal saline. The emulsion was diluted to 1 in 50 before staining.

1st count = 27,665 millions per cc. 2nd count = 33,075 millions per cc.
Error = $\pm$ 8·9 per cent.

Conclusion.—The process, like many bacteriological methods, appears far more complicated on paper than it is in actual practice. The specimens are easily counted after a little practice, and the whole operation can be completed in three or four hours, it being done in duplicate throughout so as to provide a check on possible errors. In the writer's hands it has given better results than any method he had tried, and it seemed quite possible to keep the error below $\pm$ 10 per cent. in every case.

PEMPHIGUS CONTAGIOSUS CONTAINING LEISHMAN BODIES.

By Major W. TURNER.
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During the summers of 1903-4, while stationed at Multan, several cases of pemphigus contagiosus came under my notice in the British soldiers reporting sick at the Station Hospital. Most of the cases were in the early stage of the disease. This pemphigus contagiosus is a non-febrile disease of a highly contagious nature, as shown by the easy manner in which it spreads to different parts of the body by scratching after touching the original sore. It is characterised by the formation of vesicles varying in size from that of a pin's head in the early stage, to that of an inch in diameter in the later stage of the disease. It is not attended by inflammation, but may ulcerate, after some time, if left untreated.

The antecedent of the vesicle is unknown in some cases, but in others there is a history of an abrasion of the skin, which, in about a week's time, showed a minute abrupt vesicle at the seat of lesion. This vesicle sometimes developed quickly, but as a rule was slow in its circular growth, sometimes taking weeks to become an inch in diameter. At first it is tense, shining and transparent, but soon loses these appearances, becoming dull and flaccid, after which it is usually burst by the friction of the clothes or by the patient scratching it. From this point it gradually widens in a circular fashion, undermining the epidermis (which may long remain overlapping the sore beneath), until it enlarges to half an inch or one inch in diameter. The sore, on exposure, presents a pinkish, slightly glazed-looking patch, in the earlier stages, but becomes of a dirty ashy-grey colour later on, and is covered by a varying thickness of disintegrated tissue, which is easily removed by gentle scraping, leaving a bleeding surface.

On examining these scrapings on prepared slides and stained by Leishman's method for malaria, I discovered Leishman bodies in great numbers in some cases, and to a less degree in others. These bodies are oval, sharply defined in outline, having one end rounded and the other pointed, and measure from 2 to 4 μ in length. Inside the body is a nucleus which stains lilac and occupies from a quarter to sometimes half its size, is peripheral in position, and may be circular or variable in shape; a smaller chromatin spot, invariably

circular, is placed near the nucleus; adjoining the nucleus is a part of the body which does not stain, and beyond this the stained periphery. As the above bodies appear to be identical with the *Helcosoma tropicum* of Wright, which causes the oriental boil, it is reasonable to conclude that the "Multan sore" has an origin in the vesicular disease of pemphigus contagiosus. The cases were treated by first removing the blisters, scraping the sores, and applying antiseptics, as corrosive sublimate (1-1,000).

In conclusion, I may state that Colonel Semple, R.A.M.C., of the Pasteur Institute, India, very kindly examined one of my slides and pronounced it to contain Leishman bodies, thereby confirming my discovery.

THE DEVELOPMENT OF THE LEISHMAN BODY IN CULTIVATION.[1]

By Major W. B. LEISHMAN,
and Captain J. C. B. STATHAM.
Royal Army Medical Corps.

Part I. By Captain Statham.

Additional Notes on the Post-mortem Examination.

No ulcers on body, but two or three pigmented scars due to quinine injections which had caused some sloughing.

Lungs.—Showed typical pneumonic consolidation in both lower lobes (stage of red hepatisation) ; some recent left pleurisy.

Heart.—Normal ; 10 ozs.

Liver.—Much enlarged—106 ozs.—firm, and somewhat tough on section ; had "nutmeg" appearance.

Spleen.—Very much enlarged—87 ozs.—red on section ; no capsulitis, no infarcts ; substance friable but firm.

Pancreas.—Eight ozs., firm ; no noticeable changes in structure.

Kidneys.—Six and a half ozs. each, somewhat dark and congested, otherwise normal. *Suprarenal bodies* appeared normal.

Gastro-intestinal tract examined from œsophagus to rectum—no signs of ulceration in any part of tract ; slight congestion of small intestine here and there ; most congested part removed for microscopic examination. *Mesenteric glands.* — Not appreciably enlarged.

Brain.—Forty-six ozs., appeared healthy ; no congestion of pia mater or vessels on surface of brain ; no petechiæ or hæmorrhages.

Bladder.—Contracted, but walls looked normal.

Testicles.—Left somewhat enlarged, but this was found to be due to a hydrocele.

Bone Marrow.—Normal in appearance.

Distribution of the Parasites in the Tissues.

I. *Liver.*—A. *Smears.* Bodies found : (1) In two or three cells with polymorphonuclear nuclei and blue-staining protoplasm. One cell contained 2 bodies, one 9 bodies, and a third 29 bodies.

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[1] A preliminary note by Captain J. C. B. Statham on the subject of this article appeared in The Journal of the Royal Army Medical Corps, vol. iv., p. 13. January, 1905.

(2) In several large cells with round or kidney-shaped nuclei, surrounded by considerable amount of protoplasm; often as many as 20 bodies found. No parasites were seen in typical liver-cells. B. *Sections.* The parasites were abundant and occurred in the protoplasm of the endothelial cells lining the capillaries and lymphatic spaces.

II. *Lung.*—A. *Smears.* Leishman bodies found in: (1) Large mononuclear blood-cells. (2) Polynuclear blood-cells. (3) Several in a vacuolated mass of protoplasm, probably the remains of a cell. B. *Sections.* Bodies found: (1) A few in faintly staining mononuclear cells of alveolus detached. (2) In a cell from the alveolar lining. (3) A few in polymorphonuclear cells in the exudation in alveolus. (4) One outside lung (just outside pleura), in what looked like pleuritic exudation; it was apparently lying free. (5) One or two in connective tissue cells between alveoli. (6) In cells lining capillary.

III. *Spleen.*—A. *Smears.* Bodies found: (1) Many bodies present in large cells with faintly staining and abundant protoplasm. (2) A few in what looked like large mononuclear blood-cells. (3) One or two bodies, suspiciously like Leishman bodies, in polymorphonuclear blood-cells. (4) In one or two cells a little smaller than large mononuclear blood-cells, with protoplasm of deeper blue and with single round nucleus. B. *Sections.* (1) In one or two instances bodies appeared to lie in the connective tissue cells forming the framework of the lymphatic space of the spleen. (2) The vast majority of the bodies seen were contained in very large pale-staining cells of irregular shape. These cells appeared to line the lymphatic spaces in some cases, a portion of the cell often jutting out into the space. Often these large cells, which had round or oval nuclei, appeared to be filling up the lymphatic space. (3) In fragments of cytoplasm which looked as if they had been detached from the cells above referred to. (4) In round cells, little larger than large mononuclear cells, with well-defined margins, of which the protoplasm stained more deeply than the cells above referred to. (5) In what looked like endothelial cells lining the capillaries.

IV. *Suprarenals.*—A. *Smears.* In one cell with a round nucleus, but in which the outline of the protoplasm could not be definitely made out, three or four bodies were seen lying in the broken-up protoplasm. B. *Sections.* (1) One or two in polygonal cells with a large oval nucleus, like cortical cells of suprarenal body; two others in endothelial cells lining a lymphatic space or capillary. (2) Two or three lying free in what appeared to be the fibrous tissue of the cortex.

V. *Kidneys.*—No definite bodies found in smears or sections, but fragmentation of nuclei made decision hard to arrive at.

VI. *Bone Marrow.—Smears.* Bodies found: (1) Chiefly in large myelocytes (?) with neutrophile granules and large round or kidney-shaped nuclei (Cornil's myelocytes). (2) In smaller myelocytes with round nuclei and deeper staining protoplasm (Ehrlich's myelocytes).

VII. *Intestines.*—In sections of the small intestine (congested patches) no bodies were seen.

VIII. *Mesenteric Glands.—Smears.* No bodies found. *Sections.* No definite bodies found.

IX. *Brain.*—No bodies found in sections.

X. *Pancreas.*—No bodies found in sections or smears.

XI. *Basilar Artery.*—No bodies found.

XII. *Aorta.*—No bodies found.

The Cultivation of the Parasites.

December 5th, 1904.—A number of splenic and liver punctures were made under aseptic precautions, and the blood placed in test-tubes, each containing about 1 cc. of a 4 per cent. sodium citrate solution. These were incubated in an extemporised incubator, the temperature of which oscillated between 15° C. and 24° C. Next morning some fresh sterile human blood was added to four of the cultures.

December 6th. — (Thirty-five hours' development). Examined tubes and found—*Hanging drop:* A few Leishman bodies, which appeared enlarged (clear refracting, lightly greenish bodies); non-motile. *Stained specimen:* Leishman bodies present and mostly increased in size. Most of the bodies were free, but a few were still contained in the large splenic cells. The protoplasm of the parasites stained blue and was much vacuolated, the enlarged macronucleus consisted of a loose skein of chromatin, staining light red. The slightly enlarged micronucleus was rod-shaped and stained densely. (All specimens were stained by Leishman's modification of Romanowsky.)

December 7th. — (Fifty-seven hours' development.) *Hanging drop:* Bodies still further enlarged—mostly free. *Stained specimen:* Bodies enlarged to the size of, or a little smaller than, a red blood-cell—5-7 μ. Appearance of protoplasm and nuclei as found on December 6th.

December 8th.—(Eighty-one hours' development.) Great change found to have taken place. *Hanging drop:* Shows large round

bodies, 5-8 μ; oval bodies, 7-9 μ; and long trypanosoma-like forms, 12-20 μ. Some of the oval and all the long forms were seen to be flagellated; they were motile and moved slowly across the field of the microscope, flagellated end forward, the flagellum lashing somewhat slowly from side to side ahead of the advancing parasite. The parasites were very transparent. *Stained specimen:* Showed round, oval and long forms, as in hanging drop. Protoplasm stained blue and was much vacuolated. Macronuclei consisted of a loose skein of chromatin lightly stained; micronuclei rod-shaped and ruby-red to purple in colour. Many oval and all the long trypanosome forms flagellated, and many of these showed division in all stages; some commencing to divide, macro- and micronuclei dividing first. Other forms had completed division, and were united only by anterior or posterior extremities. The condition was evidently one of division and not conjugation, for like parts were in apposition in the early dividing forms—macronucleus to macronucleus, micronucleus to micronucleus. No evidence of an undulating membrane was found, and the micronucleus was in all cases near the base of the flagellum.

December 10th.—(Five days seven hours.) Specimens as seen in hanging drop and stained smears practically similar to those of December 8th. Some Leishman bodies were seen developing in a large splenic cell, showing that the bodies may be considerably developed before becoming free.

December 13th.—(Eight days.) In addition to forms as seen on December 8th and 10th, very small, thin, trypanosome-like forms, almost approximating to spirilla, were noticed. Agglomerated parasites were also seen.

December 17th.—(Twelve days.) Only a few parasites obtained from culture tubes. *Hanging drop:* One very motile, small form was seen; its presence was at first noted by the commotion caused among the blood-cells, and the nature of the moving body was only ascertained when it was brought to a halt for an instant by a block of cells: it was then seen to be a long, thin and small spirillum-like form. *Stained specimen:* Showed very few parasites, the same in character as on December 13th.

December 19th.—(Fourteen days.) Very few parasites found. *Hanging drop:* Parasites not clearly defined and not motile. *Stained specimens:* Showed that the parasites were much broken up; they stained badly, and were evidently degenerating.

After this date only degenerated forms were found. The parasites had, therefore, lived for about fourteen or fifteen days in the

citrated splenic and liver blood tubes. Some difficulty was experienced in obtaining satisfactory films, as the parasites appeared to develop in a jelly-like substance (probably broken-down splenic pulp) at the bottom of the tubes, and it was only when one of these jelly-like masses could be hooked up through the supernatant layer of citrated plasma that a good film could be obtained. If the cultures were previously shaken up parasites were often found, but they were not numerous. An impression was gained that the parasites developed better in the splenic cultures to which sterile human blood had been added.

Notes on Sub-cultures.

(1) *In Fresh Sterile Human Blood.*—On December 9th, 1904, about 4 cc. of human blood were placed in sterile tubes containing 1 cc. of a sterile 4 per cent. solution of sodium citrate. Into this medium four or five loopfuls of the splenic cultures were placed, and the tubes incubated at 20° C. Three days afterwards (*i.e.*, on December 12th) some evidence of a growth in the tubes was noticed. The growth consisted of small, greyish, granular masses, about the size of a small pin's head, lying on the surface immediately above the layer of white blood-cells, which formed a whitish-pink bed beneath them. Three such granular growths were found in one tube, separate from each other; two in another tube; while in the third culture there was a larger lump, which appeared to consist of two or three small masses heaped together. The granular, round growths were somewhat transparent looking in parts by transmitted light, while by reflected light the growth looked more opaque and grey. The difference may have been due to part of the growth being the material from which the parasites were growing, while the clearer portions consisted of the zooglea colonies of the parasite itself. From these growths parasites were obtained exactly similar to those found in the citrated splenic blood tubes. By December 16th (*i.e.*, eight days after the inoculation of the tubes) growth appeared to have reached its maximum, although the size of the colonies was but slightly increased from that noted on December 13th (*i.e.*, four days after inoculation of the tubes). On December 16th parasites were again obtained from these growths. After December 16th the growths began to melt away, and the parasites obtained were found to be degenerated. The parasite had, therefore, lived and grown in the culture of human blood for eight or nine days.

(2) *Ascitic Fluid.*—A tube of sterile ascitic fluid was inoculated on December 10th, and examined four days after, the fluid being centrifuged to obtain any parasites that might be present. A few bodies which looked like degenerated parasites were recovered, but none stained well.

(3) *Tubes of* (i.) sterile tap water, (ii.) sterile pond water, (iii.) ordinary pond water, were inoculated on December 10th from the splenic cultures.

On December 14th, four days after inoculation, a portion of each of these tubes was centrifuged and the deposit spread on slides. No parasites were found in the sterile tap water; a few broken-down parasites were recovered from the sterile pond water, but these stained badly. In the ordinary pond water many animalculæ were found, but nothing that resembled the Leishman body in any of the stages of its development. In hanging drops from the tubes of sterile tap and pond water no motile organisms were found. From this it appears that the parasite does not thrive well in water at 20° C.

Notes on some other Work in Connection with Cases of Dum-Dum Fever.

(1) *Fæces* of the above case were during life highly diluted and then incubated at 20° C.; films made from a portion of this dilution after centrifugalisation were examined every day for six days. This examination was carried on intermittently for two or three months, and some 150 slides examined, but nothing found. Dilutions of *urine* were similarly incubated and examined, with negative results. Fæces and urine of another case of Dum-Dum fever in hospital were similarly incubated and examined, and nothing found.

(2) *Purpuric spots* and small blebs which appeared on the leg of an undoubted case of Dum-Dum fever were examined, smears being taken from the ulcerated surface left after bursting of the blebs. No Leishman bodies were seen.

(3) *Finger blood* of a third case of Dum-Dum fever was drawn off into a small quantity of citrate of soda solution and centrifuged so as to get a layer of white blood-cells. No Leishman bodies were recognised in slides prepared by smears from the layer of leucocytes. The centrifugalised blood after incubation at 20° C. showed no flagellated bodies.

(4) *Ascitic fluid*, drawn off from a case of undoubted Dum-Dum fever in the last stages, and centrifugalised to obtain white blood-

cells, showed only two bodies in some hundreds of cells. Both these bodies were in large mononuclear cells. The fluid drawn off aseptically and incubated for two days showed no parasites.

My thanks are due to Lieutenant A. H. Proctor, I.M.S., for his valuable assistance and co-operation in much of the work recorded above.

Part II. By Major Leishman.

The Development of the Parasites in Cultures.

The first sign of change is seen in the blue-staining protoplasm of the spleen parasites, which loses its transparent hyaline appearance and becomes more granular and opaque (fig. 1, *2*, and plate, fig. 3). The parasites then commence to enlarge, retaining, however, their original oval or circular shape; this initial enlargement appears to be due, at least in part, to the enlargement of the macronucleus, which from occupying about a quarter of the parasite comes to fill half or more (fig. 1, *3* and *4*, and plate, figs. 4 and 5), This enlargement of the macronucleus is soon followed by an increase in the quantity of protoplasm, which now takes a deeper blue tint with Romanowsky's stain. The micronucleus appears to be somewhat enlarged, but retains its characteristic shape, usually that of a short, slightly curved rod, and it displays the same intense affinity for this stain, appearing almost black even after short staining.

A marked feature in the process of development in all our films was the early appearance of vacuoles in the protoplasm; these were always circular in outline and fairly uniform in size, having an average diameter of ·5-1 μ; very rarely larger ones were seen of a maximum diameter of 3 μ. These vacuoles, as will be noticed from the forms figured in the coloured plate, persist throughout all the stages of development, and comparatively few parasites were seen in which they were absent. As to their nature and function, it seems probable that they are nutrition vacuoles concerned in the rapid process of growth, but as Rogers' did not mention them in connection with his culture, it is possible that they may be due to some difference in the tonicity of the citrated plasma employed in his cultures and in ours.

Growth at this stage is very rapid, the quantity of vacuolated protoplasm increasing, while the macroneucleus becomes greatly enlarged and its chromatin network loosened, while its staining reaction is much feebler; the micronucleus, however, at this stage, appears to undergo no further enlargement or alteration.

From the earliest stages of growth of the spleen parasites multiplication by fission occurs; and even in very young cultures large

DESCRIPTION OF COLOURED PLATE.

FIG. 1.—Large splenic cell containing parasites.

,, 2.—Various forms of the parasites as seen in smear preparations from the spleen.

,, 3.—Early stages of development of the parasites in cultures.

,, 4.—Further developed forms, some showing stages of division.

,, 5.—Group of young parasites, some flagellated.

,, 6.—Small group of oval, non-flagellated forms.

,, 7.—Young flagellated parasites.

,, 8-16.—Various forms of fully-developed flagellated parasites.

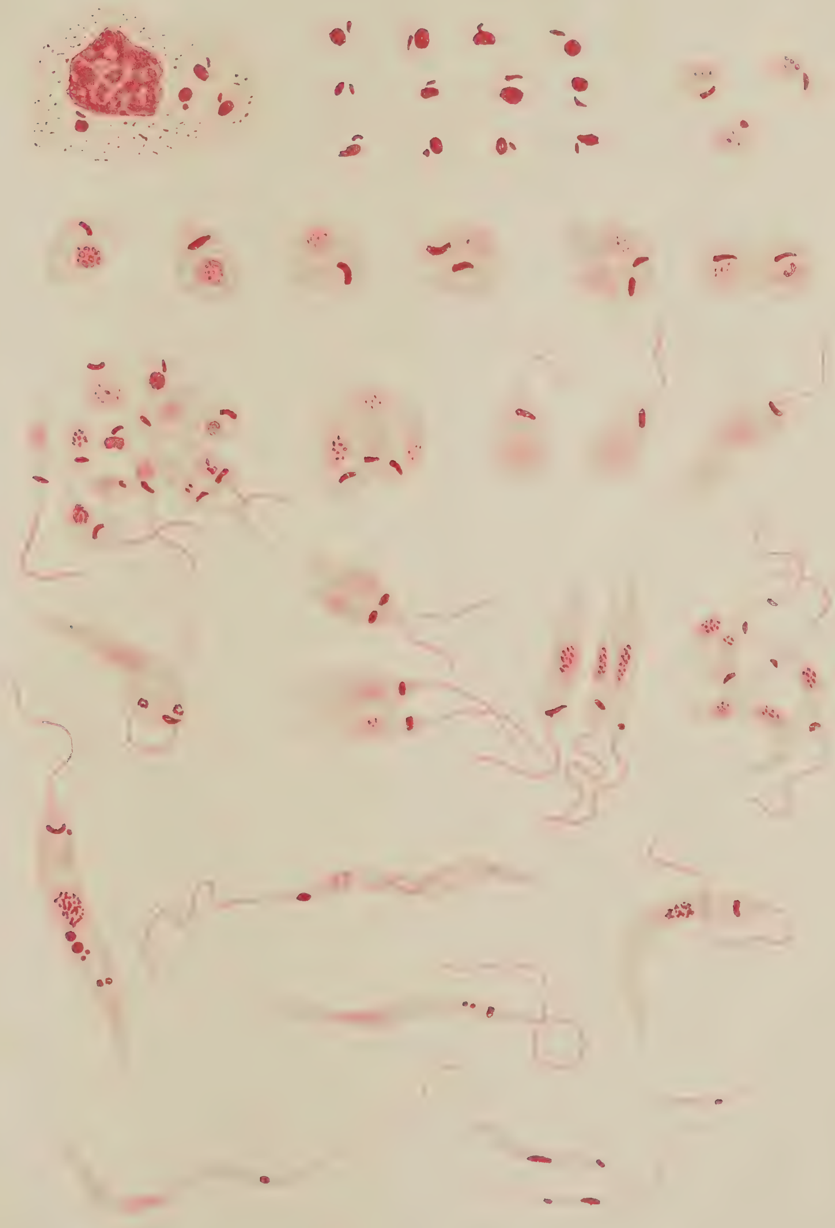
,, 9, 10.—Division forms.

,, 11.—Group of flagellated forms.

,, 12.—Form showing the disposition and shape of the chromatin granules.

,, 17.—Small, flagellated "spirillar forms."

All the figures have been drawn from specimens stained by Leishman's stain.



numbers of fission forms are to be seen in all stages (plate, fig. 4). As a rule, the first sign of this fission process is seen in the macronucleus, which becomes in succession elongated, constricted in the middle and, finally, separated into two distinct parts. Similar division of the micronucleus follows, but occasionally this may precede the division of the macronucleus forms being met with containing two micronuclei and but one macronucleus. As a general rule the process is completed by simple cleavage of the parasite into two independent parasites, but at times a single parasite may give rise to three or even to four new individuals, by a process of further subdivision of the macro- and micronuclei.

As this fission goes on considerable masses of young parasites are formed; they are circular or oval in shape and of an average diameter of 6-7 μ, or approximately equal in size and shape to red blood corpuscles (plate, fig. 5). These developmental changes, up to and even beyond this stage, may also take place while the parasites are still embedded in the protoplasm of the splenic "macrophages."

Once the above stage has been reached further development appears to proceed with varying degrees of rapidity, as, twenty-four hours later, a great variety of forms were seen, many of them fully-developed flagellates, while among them were to be found all the earlier stages as well as the intermediate forms now to be described.

The next step towards flagellate form consists in an alteration of the shape of the parasites; from being circular or oval they become elongated, usually thicker at one end than the other, and often distinctly pyriform, the protoplasm and the macro- and micronuclei preserving the characters seen in the circular forms. At this stage, also, multiplication by simple longitudinal fission occurs. By this time a flagellum has in most instances appeared, and it is of interest to note that this structure may even be developed while the parasite is still definitely circular in form.

The development of the flagellum is, apparently, a very rapid process, as the enormous majority of the parasites examined were either definitely non-flagellated or were in possession of a fully-developed flagellum of the usual type and staining reaction. By prolonged study of the films, however, forms have been met with which appear to illustrate some of the stages of the developmental process; a few of these forms are illustrated in fig. 1.

The first change which appears to take place is the development of a circular, pink-staining area in contact with one side of the micronuclear rod (fig. 1, *4*). At times, however, this pink zone may

be more diffuse and less definite in outline, appearing to merge in the blue-staining protoplasm of the parasite. In two or three instances this pink zone, which may be termed the "flagellar vacuole," without prejudice to its real nature and function, attained a size equal to half the diameter of the parasite itself (fig. 1, *5*). The micronucleus at this stage may remain apparently unaltered, or may, as in the example figured, change in shape to a small circular mass of deep-staining chromatin; in one case no trace of the micronucleus was seen, but the margin of the vacuole showed

FIG. 1.—STAGES IN THE DEVELOPMENT OF THE FLAGELLUM.

(*1*) Ordinary form of spleen parasite; (*2*) slightly enlarged parasite, from a young culture; (*3*) further stage of growth, vacuolation of the protoplasm; (*4*) development of the "flagellar vacuole" close to micronucleus; (*5*) increase in size of "flagellar vacuole"; (*6*) rupture of vacuole and protrusion of the young flagellum in the form of a tuft or bunch of pink-staining threads; (*7*) growth of the flagellum, the thickened base being inserted in the collapsed flagellar vacuole; (*8*) trypanosomal form with fully-developed flagellum.

a deeper tint of chromatin than the pink homogeneous contents of the vacuole itself. Following on this enlargement of the vacuole the next stage appears to be the rupture of the thin rim of protoplasm or of cuticular substance which forms its external border, and the protrusion of part of the contents of the vacuole in the form of a fringed process or tuft of the same staining reaction as the contents of the vacuole, and also of a fully-developed flagellum (fig. 1, *6*). Such forms were only rarely seen, but in all of them the same picture presented itself of a bunch or tuft of pale pink threads starting from the neighbourhood of the micronucleus, passing outwards through the partially collapsed flagellar vacuole, and projecting for a distance of 3-5 μ clear of the body of the parasite.

Of the next stage examples were rather more common; here the

flagellum tapers slightly from its apparent origin at the bottom of the flagellar vacuole towards its free extremity, while its length is now about half that of the parasite (fig. 1, *7*). After this the flagellum apparently increases very rapidly in length, as very few forms were seen between the last stage and that of the fully-developed flagellum, which is usually of about the same length as the parasite to which it is attached and uniform in thickness throughout (fig. 1, *8*). In many instances it may still be seen to have its origin in the remains of the pale pink vacuole, which apparently persists for some time; but in some of the most fully-developed parasites it appears to be inserted directly into the protoplasm of the parasite, its point of origin being invariably in the immediate neighbourhood of the micronucleus, though it does not appear to be directly connected with this structure.

The flagellum always arises from the rounded end of the parasite, and projects at once clear of the body into the surrounding fluid, and does not course down the body and project beyond the pointed extremity, as in the case of a trypanosome. This point will be referred to again.

The motility of the flagellated forms is, as a rule, sluggish and the parasites advance with the flagellar end foremost. The most active individuals were the thin spirillar forms described below.

Considerable variations were met with in the shape and structure of the macronucleus. A few young flagellated forms were seen in which the nuclear chromatin appeared brightly red and nearly homogeneous, and in these the protoplasm was usually more darkly stained than usual and free from vacuoles. As a rule, however, the nucleus appears granular, or in the form of an irregular network of chromatin threads. The granular ones showed considerable irregularity both in the numbers and the arrangement of the granules, the most frequent appearance being that of a wreath, or ring, of chromatin granules, enclosing a non-granular central zone. These granules are most probably chromosomes, and from the variability of their numbers, as well as from other variations noted in the shape, size and staining reactions of the parasites, it appears possible that there may be a sexual differentiation among these flagellated forms. Further experience and more extended observation are, however, necessary, before this point can be definitely affirmed.

In many of the parasites small chromatin dots, distinct from the macro- and micronuclei, were found in the protoplasm. These varied much in size, but were usually definitely circular in outline and tended to occur in pairs resembling small diplococci (plate,

fig. 12). They were most numerous in the younger stages prior to exflagellation, but were also found in many of the mature parasites. From their appearance, arrangement and staining reactions, these granules appear to represent various stages in the mitosis of a blepharoplast or accessory nucleus, such as has been described by Schaudinn,[2] in connection with *Trypanosoma noctuæ*, it was not, however, possible to detect any filament—representing the central thread of the spindle—connecting the pairs of chromatin dots to one another or to the parent nucleus. As far as could be seen with the magnification employed (1,000 diameters), there was a slight difference in size between the individuals of each pair, so that if it is the case they are concerned in a mitotic process, the resulting spindle is probably heteropolar. Occasionally these chromatin dots were seen in the neighbourhood of the micronucleus, and it is not impossible that such may have been concerned in the development of the flagellum, but they were much more frequently found close to the macronucleus, and no further details were detected pointing to flagellar development occurring upon the lines described by Schaudinn. The two cases further present the following difference, that in the case of *Trypanosoma noctuæ*, there is at first only the single nucleus of the ookinet of the halteridium, from which a blepharoplast has to be formed prior to the elaboration of the flagellar apparatus; whereas, in the case of the parasites under discussion, the micronucleus, which is usually accepted as being a blepharoplast, is already in existence.

Multiplication by longitudinal fission apparently occurs during the flagellated as well as during the non-flagellated stage, but in the case of many of the twin parasites it appeared likely that fission had taken place at an earlier stage, and that the twins had grown to maturity side by side. Mature forms showing a preliminary division of the macro- and micronuclei, though met with at times, were rare.

A curious process of unequal longitudinal fission was observed in some of the mature flagellated forms, and in this process the nuclei of the parent did not appear to play any part. The result of this process was the splitting off of a thin spirillum-like parasite from one side of the mature flagellate, and sketches of parasites showing various stages in this method of multiplication are given in fig. 2. Occasionally a form was seen showing that more than one such form might be split off from the same parent (fig. 2, *6* and *7*.) These thread-like forms have usually two or more chromatin dots in their substance, and often show as well the characteristic vacuolation of the protoplasm, but no further details could be made out owing to their minute size. When newly-separated from the

parent they are destitute of a flagellum, but this is subsequently developed (plate, fig. 17), and these spirillar flagellated forms showed much more active motility than the larger parasites.

The possession of chromatin by these minute thread-like forms suggests the possibility that they may undergo a further process of longitudinal division and, if this be so, it is conceivable that the products of such further division might be of ultra-microscopic size, and we should then have a possible explanation of some of the

FIG. 2.—FLAGELLATED PARASITES GIVING RISE TO SPIRILLAR FORMS BY A PROCESS OF UNEQUAL LONGITUDINAL FISSION.

(*1–5*) Cleavage of single spirillar forms from the parent; (*6*) parasite giving rise to two spirillar forms; (*7*) two spirillar forms completely separated from the parent.

puzzling features in the etiology of the disease to which they give rise. The resemblance, again, between these minute forms and the spirochætes is obvious and at the same time suggestive, in the light of Schaudinn's work on *Spirochæte Ziemanni*.

Nothing of the nature of a conjugation process was observed, and although forms similar to those described and figured by Rogers as conjugation forms were seen, they appeared in all cases to be division forms in which separation was incomplete.

With regard to the biological position of the parasite, it will be seen from the above description and from the figures that the most fully developed of the flagellated forms differ from true trypanosomata in two points only, the course taken by the flagellum and the absence of an undulating membrane. It has been proved, however, that trypanosomata in cultures may differ considerably from the form in which they occur in their host, and it is not till such cultural forms are once more introduced into a suitable host, that they resume their classical form. For instance, Smedley[3] has recently shown that in the case of cultures of *Trypanosoma Lewisi* the parasites are destitute of an undulating membrane, and their flagella project at once clear of the parasite instead of coursing along the body and projecting beyond the tapering extremity of the parasite.

It appears, then, from the facts at present available, that the spleen parasites, or "Leishman bodies," are undoubtedly a stage in the development of a flagellated organism and, further, that nothing has yet been observed in the flagellated forms inconsistent with their eventually proving to be trypanosomata.

It should not, however, be concluded that the last word upon the nature of the parasite has been said when it has been assigned its proper place among the flagellata. In view of the striking pleomorphism which it has been shown to exhibit under cultural conditions, it would be rash to assume that the forms figured and described in this article and elsewhere, exhaust its possible changes of form, and it may yet be found to exist outside the body of man in a shape as widely different from those at present known as the flagellated forms themselves differ from the spleen parasites.

I need add little to Captain Statham's description of the cultural characters of the parasite. The cultures which I obtained from him, however, retained their vitality somewhat longer than his, the last motile parasite being seen on the twenty-first day, and evidence of growth and development was observed in a first and second sub-culture made in citrated human blood. A number of animal experiments were undertaken with the cultures, both by inoculation and by feeding, so far with negative results. Some of these experiments are, however, not yet concluded, and should they prove of interest they will form the subject of a further communication.

References.

1 L. Rogers, *Quarterly Journal of Microscopical Science*, new Series, No. 191, p. 367, November, 1904.

2 F. Schaudinn, *Arbeiten aus dem Kaiserlichen Gesundheitsamte*, vol. xx., p. 387, 1904.

3 R. D. Smedley, *Journal of Hygiene*, vol. v., p. 24, January, 1905.

THE ANKYLOSTOMUM, THE STRONGYLUS, THE TRICOCEPHALUS, THE ASCARIS, AND AN ASSOCIATED INFUSORIAN IN WEST AFRICA—CHIEFLY IN REGARD TO MILITARY INEFFICIENCY; MODES OF INFECTION, AND LIFE-HISTORY OF THE PARASITES; ALSO A NOTE ON AN UNIDENTIFIED WORM.

By Major F. SMITH, D.S.O.
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(*Continued from p.* 205.)

Part II. (*continued*).

Before detailing the infection experiments, it may be as well to say that claims to the discovery of a free form of the *Ankylostomum duodenale* have been made by more than one observer—prominently among British observers, Lieutenant-Colonel G. M. Giles, of the Indian Medical Service, in 1899. In a discussion on "Ankylostomiasis" at the British Medical Association's meeting at Ipswich in 1900, Lieutenant-Colonel Giles described his discovery of a free form which, found in large fæcal masses on the plains of India, arrived at sexual maturity in four days at a temperature of 80° to 90° F. In his own laboratory they took six to ten days to arrive at maturity.

Sonsino appears to have objected to Giles's results on the grounds that the organisms described were really *Rhabdonema intestinale*, *Rhabdites terricola*, or other free nematodes.

Major Ronald Ross, I.M.S., joining in the discussion, said that he had partly followed Giles's experiments. He considered them sound, and Sonsino's criticisms unsound.

In 1902 Dr. A. T. Ozzard (*Journ. Trop. Med.*, September 1st, 1902), reported that he had repeated Giles's experiments, and had been able to "completely confirm" them. Ozzard's organism is said to have taken eight to ten days to develop. I have not seen any figures by Colonel Giles, but from the long period required for growth it might be concluded that the organisms mentioned by the two observers were not the same as those which I have described. The methods, however, as given in Ozzard's article, and said to be after Giles's plan, seem open to criticism. The preparations may have been infected by the fly while under observation. The figures in Ozzard's article bear little or no resemblance to mine. It is a

moot question, then, whether we have all dealt with the same organism. At all events, both Giles and Ozzard believed that they had discovered a free form of the ankylostomum. Moreover, they both stated that *the embryo of the adult worm grew directly into the free form* (I held the same opinion until I endeavoured to prove it in the manner already detailed). Their results, however, have not been universally accepted. Our greatest British authority—Sir Patrick Manson—writing after the publication of their experiments, only commits himself to the extent of saying that, "During rainy weather the ankylostoma ova in the fæcal materials are hatched, and the free embryos escape into and *probably* multiply in the damp earth."[1] Speaking of Giles's discovery, he remarks that "His observations, at one time disputed, are now upheld by Sandwith and other observers." Daniels, on the other hand, in his newly published "Laboratory Studies in Tropical Medicine," 1904, definitely states that there is a free-living form, but he gives no particulars, and quotes no authority.

Whichever way it be then, whether Giles's and Ozzard's free-living organisms and mine are or are not the same, the accounts of the life-history are different. *Connection with the Ankylostomum duodenale, too, remains to be proven.* I am satisfied that my organism is not the free form of *Rhabdonema intestinalis*. As will appear further on, however, there is in West Africa a third free-living organism found sometimes in human fæces, and this fact accentuates the need of establishing the identity of the more common worm.

Infection Experiments.

Three monkeys, previously free from ankylostomes, were fed with "travellers" from the surface of dog fæces, with the following results :—

"Mahquee" (Mango monkey), given about 150 "travellers" by the mouth, next day fifty, third day about twenty. Nineteen days later embryos were obtained from the fæces. The fæces became well stocked with ova (exact date of first appearance not known). Five weeks after the first administration he was again fed with "travellers," on five successive days. The monkey became weak and ill—not from pure ankylostomiasis (?). He died six weeks after the first administration. Most of the ankylostomes had become loose in the intestine ; some sixty were picked up. Possibly more were in

[1] "Tropical Diseases," Manson, last Edition (1903).

the fæces. He was suffering from double pneumonia. He had other intestinal worms than ankylostomes.

"Town Councillor" (black monkey) was given "travellers" by the mouth on three consecutive days. Ova appeared in the fæces on the sixteenth day, counting from the first dose.

"Eliza" (Mango monkey), given thirty "travellers" by the mouth on one day only. Ova of ankylostomes were found in the fæces on the seventeenth day.

Among eight other monkeys kept in the same place and on similar food, but not all at the one time, none developed the parasite. These eight, however, were not kept during the rainy season — those which contracted ankylostomiasis *were*, and the ground they were on *may* have been polluted. But I have since that time kept monkeys for months on this same ground during the rains, and they have not contracted the disease. All the monkeys had been in the possession of natives and thus subjected to risk of contracting the disease before I got them.

I had not found ankylostomes in any monkeys up to the time of the above experiment. I had made no extensive search. At a later period I purchased, among others, two Mango monkeys which were the subject of natural ankylostomiasis in a slight degree: both recovered spontaneously in the course of two months, while living on the ground occupied by the above-mentioned experimental animals.

Three pups about a month old were cleared of their ankylostomes by thymol and male fern and were treated as follows:—

"Mary" was fed on three successive days with "travellers" taken from the surface of her own fæces, which had been collected before she was given anthelmintics.

"Blazer" had a foot wrapped in a wet rag containing many "travellers"—not from his own fæces—for an hour daily on three successive days. He was prevented from licking the rag or putting foot to the ground. After each application the foot was washed in 1 per cent. lysol and then placed under the tap.

"Necklace" acted as control.

All three pups were caged and fed alike; their food was boiled. After having been cleared of their original parasites, they were placed in separate new cages made of wood. Their fæces were examined daily after the seventh day. On the eleventh day "Mary" showed a few ova, the others none.

On the fourteenth day "Necklace" was found to have an ovum or two.

On the sixteenth day "Blazer's" fæces contained a good many ova.

The three pups were killed on the twenty-first day and their parasites counted—the result being:—

Mary ..	.. embryos by mouth ..	..	3 parasites.
Blazer ..	.. ,, to skin ..	..	56 ,,
Necklace	.. control	..	9 ,,

This result was quite different to what I had expected and is rather contradictory compared with the monkey experiments, in that it shows infection by skin only and not by the mouth. "Mary" unfortunately was given embryos from her own fæces by way of a double experiment, with regard in the second instance to self-infection.[1] All the experiments are more or less vitiated by the fact that the animals are so easily infected naturally in tropical Africa. Possibly in all three pups there remained a few parasites after the thymol. Again, embryos may have been on their way from the skin when the thymol was given and so have been unaffected by the drug (the experiments, that is to say, were performed too soon). The cages were cleaned out, but were not disinfected daily—it is conceivable therefore, that the wooden floors became infected in some way. The cages differed only in size—"Necklace's" being smaller than the others; they were kept off the ground by means of stones.

With regard to the monkeys, again, there is no certainty that they were not infected naturally either by mouth or skin. The fact, however, that I have found strongyles in every monkey examined and ankylostomes in two only points to a natural resistance of some breeds of monkeys to ankylostomes. Compare, for instance, dogs. I have not yet found in Sierra Leone a dog free from ankylostomes. The two monkeys naturally infected had ova in the fæces when first received at the laboratory.

The experiments, then, are too few in number and too contradictory in result to be of much value. As far as they go they indicate that *infection may be either by the mouth or skin.*

Fruitless attempts were made to infect guinea-pigs by the mouth and skin with dog ankylostomes.

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[1] Regarding self-infection, a pup obtained for experiment was in the habit of devouring its own fæces, which contained many ova. The pup passed hundreds of living embryos *per rectum*—yet there were very few adult forms in the intestine.

Question of Infection of Man by Animals.

The experimental results suggest intercommunicability among animals; inferentially we may suspect that man can contract ankylostomiasis from the lower animals.

An Objection.

The infection experiments above detailed have been carried out with "travellers" taken from the surface of ankylostomal fæces; they cannot, therefore, be taken as evidence that the "traveller" from the free-living organism is ankylostomal. It is conceivable that in picking off the embryos of the free-living organism I may have at the same time taken up embryos directly descended from the adult ankylostome.

In the following experiments the risk of contamination by embryos from the egg of the adult worm was excluded.

Infection Experiments with "Travellers" born of the Free-living Organism.

"Monkey Brand" (black monkey) was fed on "travellers" from the eighth agar sub-culture off dog fæces. Eleven days later ova of ankylostomes appeared in his fæces. The ova were few in number. The monkey had been kept on a clean piece of ground, previously unoccupied.

"Gollywog" (young Mango monkey), given "travellers" off eighth sub-culture, by the mouth. Seven days later he was killed. No ankylostomes were found in the animal.

"Pinta" (young Mango monkey), "travellers" from agar sub-culture to skin for one hour; skin then washed with 1 in 30 carbolic. Sixteen days later there were no ova in the monkey's fæces.

"Paul" (pup about a month old). Embryos from sub-cultures on agar were applied to the belly for half-an-hour on three successive days. Pup killed on the eighth day. Only three young worms in the intestines. Killed too soon (?). Lungs studded all through and on surface with hæmorrhagic or pneumonic patches. A lung was cut up and triturated with water. In the resultant fluid were found three worms which might be embryos of the ankylostome. This reminds me that "Mahquee," the monkey who died, had double pneumonia. He had been fed repeatedly with embryos. If the organisms found in "Paul's" lungs were the embryos artificially applied to the skin, the long stay in the

blood or tissues would suggest that a stay therein is essential—that some change is undergone before the embryo takes on the adult form. Possibly embryos taken into the mouth pass through the mucous membrane of the mouth, the œsophagus, &c., and reach the intestine by the same path as the embryos which enter through the skin.

"Beauty" (bitch in pup) was bought (her fæces contained a few ova of ankylostomes). The bitch was placed in a cage which had formerly held pups suffering from ankylostomes, but the cage had been washed, disinfected, and dried. It was kept clear of the ground by means of stones under each corner—the weather was dry. She gave birth to six pups eight days after she had been put into the cage. One pup was examined at once and found free from ankylostomes. Of the remaining five:—

"Speckles" had "travellers" from agar applied to the skin for half-an-hour on the first and third days: on the sixth day he died.

"Lucky Dog" acted as a control. He also died on the sixth day.

Neither of these two had any ankylostomes in the intestines.

"Dot" was fed with sub-cultures on agar on the first, third, fifth, seventh and eighth days.

"Mendiman," sub-cultures on agar to skin for half to one hour on the first, fourth, seventh and tenth days.

"Stumps," agar sub-cultures to skin on the first, second, fifth and eighth days.

"Dot" and "Stumps" were killed on the twentieth day, "Mendiman" on the twenty-first day.

The *post-mortem* examinations showed:—

"Dot"	cultures by mouth	17 ankylostomes.[1]
"Stumps" ..	,, to skin	16 ,,
"Mendiman" ..	,, ,, ...	20 ,,

"Dot" and "Mendiman" had inflammation of the lungs; "Stumps" had no pneumonia, but had some pericardial and peritoneal effusion.

"Beauty"—the dam—had thirty-one ankylostomes in her intestines.

The exact date when ova first appeared in the fæces of the pups was not noted. On examining the cage after the death of the

[1] Twenty days is much shorter than the period usually given for full development, even supposing that the pup was infected on the day of birth. I should place the period required for maturation at about sixteen days.

occupants I found, under the false bottom, breeding worms and others, which might, from their appearance, be embryos from either the adult ankylostome or from the free-living organism.

The death of the control animal renders this series of experiments of little value.

Three monkeys, formerly named, having recovered spontaneously —ceased, that is to say, to show ova of ankylostomes in their fæces —attempts were made to reinfect them by means of organisms derived from the fly.

"Eliza" was so fed on eight successive days. On the thirteenth day, counting from the first administration, ova appeared in small numbers in the fæces—they were found for three or four days in succession, then none were found on four successive days and the search was abandoned.

"Monkey Brand." Organisms to skin for one hour on five days. Up to the twenty-fifth day after the first application no ova were found in the fæces.

"Town Councillor." Organisms to skin for three-quarters of an hour on four days. Up to the thirty-eighth day following the first administration no ova had appeared in the fæces.

Conclusions to be Drawn from Results of Infection Experiments with the Free-living Organism.

On the whole, the evidence as to connection of the free-living organism with the ankylostomum is weak—the positive results are not very positive, and there are three pronounced negative results in attempts to infect *via* the skin, and one by the mouth.

With regard to the first experiment on "Monkey Brand," it is questionable whether the parasite could reach the adult form in so short a period as eleven days.

The breeds of monkeys used are evidently not very susceptible to dog ankylostomes ; and those that had recovered from one infection may possibly have become even less susceptible—have acquired greater immunity. That there is an acquired immunity to worms I have already suggested. It has seemed to me that, as judged by merely casual observations, pups are more subject than adult dogs to intestinal parasites. For an example of this see further on under *Ascaris lumbricoides*.

Analogy would certainly lead us to expect that the ankylostome has a free-living form. Since the first part of this article appeared in print I have come across ankylostoma-like, blood-sucking, intes-

tinal parasites of lizards, frogs and toads. Some of these worms have a free-living form, both sexes of which resemble, in a general way, the organism derived from the "Grey fly," but they (under artificial conditions, at any rate) arrive at their free stage without the aid of an insect host. The embryos of these reptilian worms are generally hatched out in the intestine of the host, and have begun to grow before extrusion. Were it not so they would scarcely have time to grow up before the small volume of fæces passed by the hosts had dried up. They grew on intestinal mucous membrane; they also did well in the hosts' fæces when kept moist. They mostly breed in water.

I was first led to examine lizards owing to my having seen them looking for their insect prey among fæces. I sought out frogs because they lived in our drinking water and are insect-eaters. Some infected grey flies kept in cages for experimental purposes had been observed to be dead in the drinking water provided for their consumption. The dead flies had, in a way, infected the drinking water with the organisms. The worms increased and multiplied in the dead bodies of their insect hosts—on which, apparently, they were feeding. Most of the parent worms remained in the flies, though a few were abroad in the water. Embryos were all through the bodies of the flies—four or five might be seen moving about inside the chitinous casing of the legs of a fly. Many embryos were drifting about in the water.

Incidentally it may be remarked that the behaviour generally of the organism in water points to the probability of its flourishing rather at the edges of a stream than in the deep water.

In leaving this subject I must apologise for the lengthy accounts of experiments, for it has to be admitted in the end that *the indentity of the free-living organism has yet to be established;* but it seemed to me to be highly desirable that an attempt should be made to settle the question one way or the other. The new generation of students of tropical medicine is being urged to buy books, the latest additions of which either lay down emphatically that there is a free, non-parasitic, sexual form of ankylostome, or leave the student in doubt.

I feel that my work will not have been wasted if I have shown (and I consider I have shown it) that *the free-living forms mentioned in recent text-books and said by Colonel Giles, I.M.S., Dr. Ozzard and others to be derived directly from the embryo of the adult ankylostome without the aid of an intermediate host have no existence in reality.*

Part III.

Intestinal Parasites commonly in Company with the Ankylostome.

The Strongylus or Rhabdonema Intestinalis.

The strongyle appears to be as common as the ankylostome in Sierra Leone. Man and the monkey are specially prone to it. This parasite has been said to be harmless, but observers are not agreed on the point. In examinations immediately after death I always find inflamed patches in the portions of the intestine which are occupied by strongyles.

The eggs hatch out in less than twenty-four hours as a rule—in man they are supposed to hatch out before extrusion from the host. In the monkey the larvæ are more or less outlined in the egg when passed *per anum*. This serves to distinguish them from the newly passed eggs of the ankylostome. They are, too, smaller than the ankylostome eggs and have not, as a rule, the characteristic clear space between the contents and the shell.

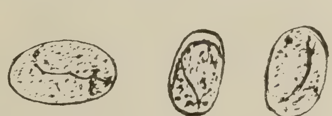


Fig. 21.—Eggs of *Strongylus intestinalis*, newly passed by monkey.

When first extruded by the adult worm the eggs are yolked like ankylostome eggs. The embryos seem quite at home in water.

The Male "Rhabdonema Intestinalis."

The *adult male parasite* is said by Manson and others to be unknown. Scheube ("Diseases of Warm Countries," 1903, p. 454) repeats the idea that the worm is hermaphroditic. I was lucky enough to find the male worm in the monkey, two only among crowds of females. I am informed, however, by a letter from Mr. F. Jeffrey Bell, of the British Museum, to Colonel Bruce, that the male of this parasite in man was described and figured so long ago as 1881 by Perroncito.

The Tricocephalus Dispar.

This worm is very common in Sierra Leone among men. It is met with also among monkeys. Like the strongyle, it has been reputed harmless. E. Becker (*Deut. Med. Woch.*, June 26th, 1902;

Brit. Med. Journ., Epitome, January 24th, 1903) gives cases in which he thought anæmia to be due to tricocephalus. Anyway, it cannot be desirable to have an intestine stocked with these parasites; the process of becoming acclimatised to the numerous organisms which inhabit the intestine of the resident in the Tropics must be debilitating.

The eggs of tricocephalus lie a long time in water without hatching out. I have seen the embryo writhing in the shell after six weeks' immersion of the egg in water: we may infer that it is waiting for something.

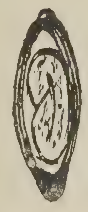


FIG. 22.—Egg of *Tricocephalus dispar* after six weeks in water.

The Ascaris Lumbricoides.

This universal pest is of course with us. Almost every native has it. It is not so common among the troops, and is not supposed to be injurious. Staff-Surgeon F. H. A. Clayton, R.N., in the *Journal of Tropical Medicine* for February 2nd, 1904, however, showed that the *Ascaris lumbricoides* may cause serious trouble to the fighting man, as exemplified in the cases of some seamen of the Royal Navy in China. Like the tricocephalus, it does not hatch out readily in water, even in the Tropics. I have some eggs of the round form of both man and the dog which, after more than three months in water, show moving embryos in the shells, but none have hatched out. In some other media they seem equally backward. About fifteen days in this climate and season, temperature about 70 to 89° F., is required for the embryo to become visible and moving in the egg. But the variation in rate of development is wide. In a specimen of fæces some eggs may be found to contain moving embryos, while others have not advanced beyond the single-yolk stage.

In puppies aged twenty days I have found adult worms, the fæces of the puppies being well stocked with ova. The period required for maturation of the "round-worm" (in the dog) must therefore be not more than twenty days, and is probably less. How easily pups acquire parasitic worms may be judged from the fact that

these pups were born and spent their life in a wooden cage. The mother had been in the cage eight days before the pups were born, and she never left it from the time she was put in until the day on which the pups were examined. She ate her food off the floor of the cage. The pups lived entirely on mother's milk. Where did these pups get the round-worms from?

A pup suffering from round-worms had previously occupied the cage, but the cage had been washed out, disinfected aud dried before the bitch was put into it. The bitch herself was not passing round-worm ova, and, examined on the same day as the pups, had only one immature male worm in her intestine, whereas the three pups had 17, 14 and 16 respectively. Obviously the pups were not infected by the mother. If they were infected by means of eggs or embryos off the floor of the cage, it is strange that the bitch, which had been in the cage for a much longer period than the pups, and had taken her food off the floor all the time, remained practically free. The simplest way out of the difficulty is to assume that the *bitch had acquired a comparative immunity to round-worms*, but such an explanation is not very convincing.

Experiment.—A monkey was given canine round-worm eggs in which the embryos had been formed and moving for some weeks, and another was given ova which were still in the yolk stage. The monkey's fæces were examined frequently for four weeks, but no ova were found.

Experiment.—A pup was fed with round-worm eggs from human source—these eggs were three months old and contained moving embryos. The fæces examined daily after the seventh day up to the twenty-first day showed no ova. The pup was then killed—there were no round-worms in the intestine.

Experiment.—A pup duly prepared was fed with many eggs, containing moving embryos of the canine "round-worm," on three successive days. Pup killed and examined eight days after the first administration — only five young "round-worms" in the intestine.

An Intestinal Amœba or Infusorian.

This body is commonly associated with the ankylostome. If infected fæces be taken direct from the intestine (small or large) and placed in distilled water this organism appears and breeds with enormous rapidity. In water it is an active ciliated infusorian, moving rapidly in a straight line, while at the same time frequently

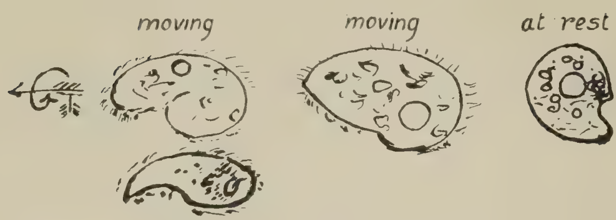


FIG. 23.—The infusorian (enlarged).

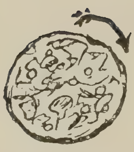


FIG. 24.—The same organism after assuming circular shape, revolving, &c.—now perfectly quiescent.

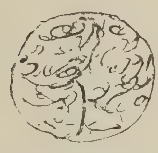


FIG. 25.—The same two hours later with contents boiling round and showing traces of segmentation.

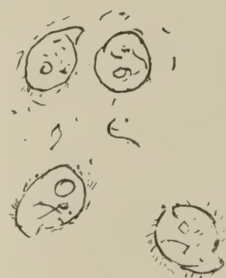


FIG. 26.—After furiously boiling for a few minutes the capsule is ruptured and the new brood escapes.

FIG. 27.—Another after two hours showing no trace of segmentation—perfectly quiescent.

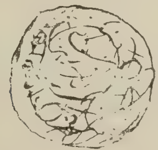


FIG. 28.—One young infusorian which remained in capsule (which it soon entirely filled) after three infusoria had escaped; its movements in the capsule soon slowed down.

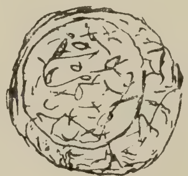


FIG. 29.—Same as fig. 28, two and a half hours later.

FIG. 30.—Same as fig. 28, three hours later; still no movement except faint contractions of protoplasm.

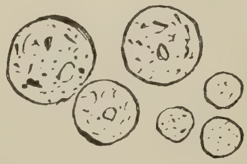


FIG. 31.—Observation of fig. 30, abandoned at dark. Next morning the water contained many homogeneously granular, motionless circles.

revolving on its long axis. It changes form a good deal; at times it is shaped something like an ammonite, again it may slightly resemble a billhook. It varies in size and density according to the richness or otherwise of its nutriment. The organism is either colourless or of a pale greenish hue. It can get along by

ENLARGED REPRESENTATIONS OF FREE FORM, OF UNKNOWN ORIGIN, FOUND IN HUMAN FÆCES.

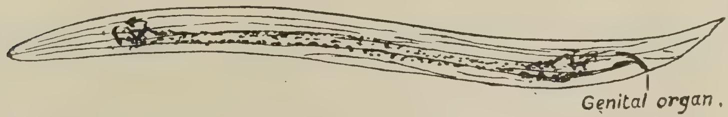


FIG. 32.—Male, free form, found in human fæces, adult unknown.

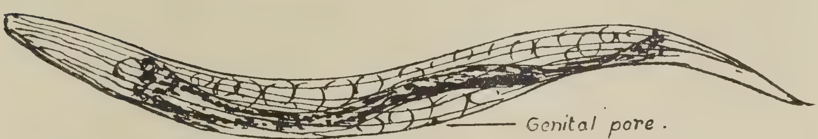


FIG. 33.—Female, free form, found in human fæces, adult unknown.

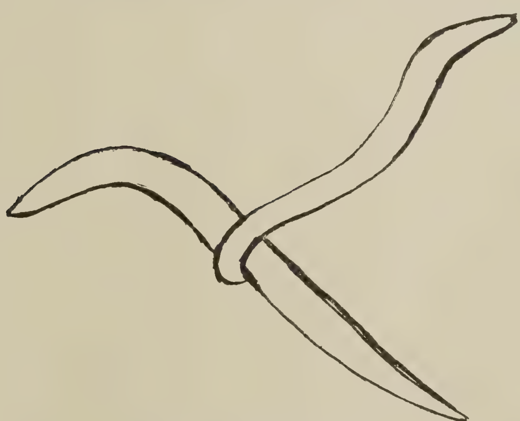


FIG. 34.—Position *in coitu*.

amœbic movements in agar, and it subsists also in gelatine and in decomposing fæces. It may be found in polluted soil. I have found it in cases of "blackwater," as well as in native men who were not apparently ill. It is uncommon among Europeans who have not been very long in the country.

The organism may or may not have a pathogenic *rôle*, but it seems to me that, in the Tropics at all events, *the infusoria in water can no longer be regarded as unimportant*. Their presence should cause a suspicion of fæcal contamination.

The mode of increase is rapid (see figs. 23 to 31).

The organisms stand a little drying. When food becomes scarce they are apt to become motionless green circles, and in this form continue to reproduce their kind.

A Free Form of Worm Breeding in Human Fæces—Adult Unknown.

On two or three occasions I have found in human fæces a breeding worm which differs from those above described. Possibly the adult worm may not be a human parasite. The male and female roughly resemble the free form of *Strongylus intestinalis*, but are shorter, stouter in proportion to their length, and more vigorous in movement. Their distinguishing feature is longitudinal striation (figs. 32, 33). *In coitu* they are slightly different to either of the two figures given before (figs. *A* and *B*). The male clasps the female at right angles to her long axis, but does not coil round by more than one turn (fig. 34). One copulative act lasts two or three minutes.

THE STERILISATION OF DRINKING WATER FOR TROOPS IN THE FIELD.

A DEMONSTRATION of processes which have been devised for sterilising drinking water on field service was given at Millbank Barracks, London, on February 10th. The Director-General and other Officers of the Corps were present, as were also members of the Army Sanitary Committee and of the Advisory Board. The methods shown comprised sterilisation by chemical means, by filtration, and by heat. Whichever of those methods is had recourse to, preliminary clarification is essential in the case of muddy waters, and this may be effected by straining or by sedimentation.

I. CHEMICAL MEANS.—The following processes were shown :—

(1) *Bromine.*— Schumburg's process. Bromine solution (contained in glass capsules, each holding 2 cc. = ·06 of free bromine, sufficient for 1 litre of water) is added to the water to be sterilised. After standing seven to thirty minutes the bromine is neutralised by adding a mixture of sodium sulphite and sodium carbonate. In about two minutes the odour of the bromine disappears, but a slightly stale taste remains.

(2) *Iodine.*—Three tablets are employed, the first containing iodate of soda and iodide of potass. coloured with methylene blue, the second tartaric acid with a red colouring matter, and the third hyposulphite of soda. Iodine is liberated from the iodate of soda by the tartaric acid, and the water is exposed to its action for ten minutes, at the end of which time a hyposulphite of soda tablet is added which exactly combines with the free iodine. After treatment the water has no smell, and is not altered in appearance, while it is difficult to distinguish any difference in taste between natural water and water thus treated.

(3) *Chlorine.*—The water is treated with bleaching powder and bicarbonate of soda. At the end of ten minutes the free chlorine is neutralised by the addition of sodium sulphite. It is, however, difficult to get quite rid of the smell and taste of chlorine.

(4) *Bisulphate of Soda.*—Fifteen grains will sterilise one pint of water. An acid taste is imparted to the water, but the acid can be neutralised by the addition of bicarbonate of soda. A further objection is that the treated water has been found to take up iron from the water-bottles.

(5) *Permanganate of Potassium.*—This is added to the water till a faint pink colour remains permanent. This process is in extensive use in India, but it is objected to by the men, partly on account of the colour, and partly because of the slight taste imparted to the water.

(6) *Copper Sulphate.*—This process is still in the experimental stage. The experiments of Dr. George Moore, of the scientific staff of the United States Government, appeared to indicate that a solution of copper sulphate, of a strength of 1 in 100,000, killed both typhoid and cholera germs in four or five hours at laboratory temperature. From Rideal and Baines' experiments in this country it would appear, however, that 1 in 1,000 copper sulphate kills typhoid and coli in one hour; 1 in 10,000 kills typhoid but not coli; and 1 in 100,000 was ineffective. A solution of copper sulphate (1 in 100,000) is tasteless and colourless; and after it has been allowed to stand no trace of copper can be detected in the water.

More interesting still are the experiments which go to show that water kept in a clean copper vessel is freed from *Bacillus coli* or *Bacillus typhosus* in twenty-four hours. Should these experiments be confirmed, their practical application to the wants of the soldier is obvious, and we will have in view a comparatively simple solution of what has hitherto proved a most difficult problem.

(7) *Alum.*—In the proportion of six grains to the gallon, alum has long been employed for the purpose of clearing water containing much suspended matter, but, in addition to purifying the water by expediting sedimentation, the alum is also germicidal in action.

Speaking generally, chemical processes are no doubt germicidally effective, but there are many difficulties in the way of their being universally practicable. The processes are largely such as could hardly be trusted to the individual soldier to carry out; and the time required for sterilisation would be a great bar, when a man is parched with thirst, however well disciplined he may be on other occasions; while there is also a widespread objection among the men to drinking "doctored" water.

II. Filtration.—Various patterns of the *Field Service Filter* were on view, illustrating its evolution and showing recent improvements. The earliest pattern consisted of a single candle filter in metal cylinder, mounted on a tripod stand with semi-rotary pump and air vessel. There was no means for preliminary clarification of the water to be filtered, and, in consequence, the candles quickly clogged and the filter soon became unusable. A special clarifying

chamber was added, in which cloth straining bags were placed, so that the water was cleared of matter in suspension before it passed to the chamber containing the filter candle. The next important variation was to encase the filter candle in straining bags. This permitted of a second candle being placed in the clarifying cylinder, thus doubling the filtering surface without materially increasing the weight of the filter. The straining bags consist of (*a*) cloth bag applied direct to candle, (*b*) perforated cylinder of thin tinned copper, and (*c*) second cloth bag externally. In the latest pattern filters, therefore, there are two vertical cylinders, each containing a single candle encased in straining bags. It has been found in practice that the vertical arrangement of the cylinders makes the filter top-heavy, and renders it difficult to keep steady when the pump is being worked, and, accordingly, in the very latest pattern of all, on the recommendation of Major Horrocks, R.A.M.C., the cylinders have been placed horizontally. The makers claim a yield of 60 gallons per hour for the two-candle filter, but at recent trials the quantity of filtered water has been 30 to 40 gallons per hour. The yield, of course, varies according to the amount of suspended matter in the water being dealt with.

Service Water-Cart Fitted with Slack and Brownlow Filters.—The adaptation of these filters to the Service water-cart is a device which appears likely to prove of much practical value. Outside the end of the water-tank a filter has been placed consisting of three chambers, two of which have each a single large-sized candle, and the third a battery of four candles. The candles are encased in clarifying bags, arranged as already described in speaking of the field service filter. The tank of the cart is filled with water, as taken from the stream or other source of supply, and no water can be drawn from the cart until it has passed through the filter.

Two other water-carts were also shown, namely, the *Bailey-Denton* cart, which has a clarifying filter of asbestos cloth with coarse and fine charcoal and a three-candle Berkefeld sterilising filter; and the *Lefebvre* cart fitted with a clarifying filter, and with fittings which allow of its being used in conjunction with a separate heat exchange steriliser.

III. Sterilisation by Heat.—Four varieties of heat exchange apparatus were shown.

(1) *Dr. Griffith's* apparatus, weighing 120 lbs. will deliver 60 gallons of water per hour with an expenditure of 1½ pints of oil; and using wood as fuel, it is stated that 25 to 30 gallons per hour

can be obtained. At the trials, the temperature of the ingoing water was 48° F., and the temperature of the sterilised water delivered ranged from 79° to 92° F. The water is not raised to boiling point, but it is heated above the temperature required for destroying pathogenic organisms.

(2) The *Lawrence* steriliser, weighing 181 lbs., will deliver 26 gallons per hour, with an expenditure of 1½ pints of oil. The water is raised to boiling point, and the sterilised water is delivered from the apparatus at a temperature 18° to 20° F. higher than that of the ingoing water.

(3) The *Forbes* steriliser, weighing 74 lbs., gives an output of 15 gallons per hour, at a temperature 10° to 16° F. higher than the water entering the apparatus. The water is raised to boiling point.

(4) The *Lefebvre* steriliser is very heavy, and on trial the yield of water was unsatisfactory.

The *Leigh-Canney* apparatus is devised for boiling water rapidly, 28 to 36 gallons of boiling water can be obtained per hour with an expenditure of 2 pints of oil.

Clinical Notes.

BACKWARD DISLOCATION OF KNEE.

By Lieutenant-Colonel A. B. COTTELL.
Royal Army Medical Corps (Retired).

On October 29th, while watching a game of football, I saw a young man fall, and on going to him I found that he had a complete backward dislocation of the knee.

I had only once seen this rare and severe injury, and in conversation since with a busy surgeon on the staff of one of our London hospitals, I learnt that he had only once seen the accident. On that occasion it was the result of a railway smash, and, being complicated with severe laceration and fracture, needed amputation.

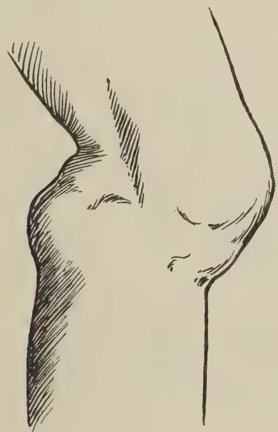


Fig. 1.

"Fig. 418.—Appearance of knee in dislocation backwards (after Pick), from p. 1014, Treves's 'System of Surgery.'"

The deformity produced in the case I am reporting was so marked that diagnosis was easy, as it was even a greater departure from the normal than the like injury depicted in Treves's "System of Surgery," page 1014 (fig. 1).

My object in writing is that the method of reduction I employed differed entirely from that given in the above work, and proved so rapid and effectual that I consider it should be reported. Both because of the acute pain suffered, while unreduced, and the dangerous stretching of and

pressure on the popliteal vessels and nerves, quick reduction is specially necessary.

The treatment recommended in the "System" for backward and forward dislocation of the knee is as follows:—

"By flexion of the leg and rotation, combined with traction in the flexed position and counter extension from the thigh, these displacements may be reduced. In the complete dislocation, powerful extension is often needful, counter extension being made on the thigh."

The indefiniteness of the method recommended above prevents any accurate criticism, but means, I take it, manipulate the joint into place.

Fig. 2.

The rotation is unnecessary and painful and the further flexion of the leg on the thigh impossible, owing to the already over-stretched Vasti tendon. The exceedingly powerful hamstring muscles are in spasm and require well-directed force if they are to be overcome without an anæsthetic.

The acute agony suffered in the case I witnessed called for prompt relief, and this I effected in the following manner:—

The patient being on his back, the pelvis was firmly held to the ground by one of his comrades. I then, kneeling and stooping as much as

possible, placed the upper and posterior part of the tibia on my shoulder, and, interlocking my fingers over the condyles of the femur, levered the articular surfaces into place, being much assisted by an onlooker whom I told to press firmly downwards on the lower third of the tibia when I gave him the word to do so (fig. 2).

I thus used mechanical leverage to the best advantage, my reward being the cry from the patient: "It can't be in, it's too quick."

The vessels were apparently uninjured, but the prognosis is of course a bad one, recovery at best being long delayed.

BULLET WOUND OF SKULL.

By Captain J. F. MARTIN.
Royal Army Medical Corps.

The following case came under my notice in December, 1903, and is of some interest, as it bears upon the question of trephining after bullet wounds of the skull.

The previous history of the case is somewhat uncertain, as it could only be obtained from the man's medical history sheet, which was not well kept up—as the man was on active service—and from what could be gathered from his wife.

Lance-Corporal F., 2nd Royal Irish Fusiliers, was wounded by a Mauser bullet at Pieter's Hill, on February 27th, 1900, in the left frontal region, the skull being fractured; nothing further could be found out about the wound except that his wife states that he was unconscious for three days.

He was invalided home, reaching Netley on April 23rd, 1900, and was discharged to duty on July 2nd of the same year, and sailed for India to join his regiment on February 7th, 1903. During the time he served at home, a period of over two and a half years, and up to the day of his death, he enjoyed good health, never suffering from headaches, fits of any kind, nor had he any symptoms of paralysis. There were no other entries in his medical history sheet bearing on the case, except an admission for neuralgia about two months before his death, and of this, it is stated, he was discharged cured.

In December, 1903, he went on manœuvres with his regiment, and had some very heavy marching to do, with the result that suddenly, on the morning of December 12th, he had a succession of epileptic seizures, about fifteen to sixteen in number, which finished in death from exhaustion, never having regained consciousness after the first attack.

On a *post mortem* being made, a depressed fracture could be easily felt over the frontal region of the left side, in the position of the old bullet wound. This fracture was about one inch long, and was situated

about half an inch from the posterior border of the frontal bone on the left side, and about an inch from the middle line. On the skull being opened it was found that this fracture extended through the whole thickness of the bone, no new bone having been laid down, the opening only being covered by a layer of periosteum. Two pieces of bone ran from each end of the fracture into the substance of the brain. The smaller piece, about half an inch long, was smooth and rounded off at the end, and was about the thickness of a lead pencil. The large piece was nearly an inch and a half in length, irregular in shape, with rough edges, and was so firmly embedded and bound down to the brain substance by cicatricial tissue, that half an inch of the end was left behind when the skull cap was removed, the membranes, which were adherent to the edges of the fracture, being torn through at the same time. There was much cicatrisation and retraction of the surface of the surrounding portion of the brain for an area about the size of a five-shilling piece.

The points to be noted in this case seem to me to be: The severity of the original wound, the apparent complete recovery for over three years, followed by death when the man was called on to do excessive work. Although there were no symptoms in the case calling for the operation of trephining, it would appear that had the man been trephined shortly after he received the wound his life might have been saved.

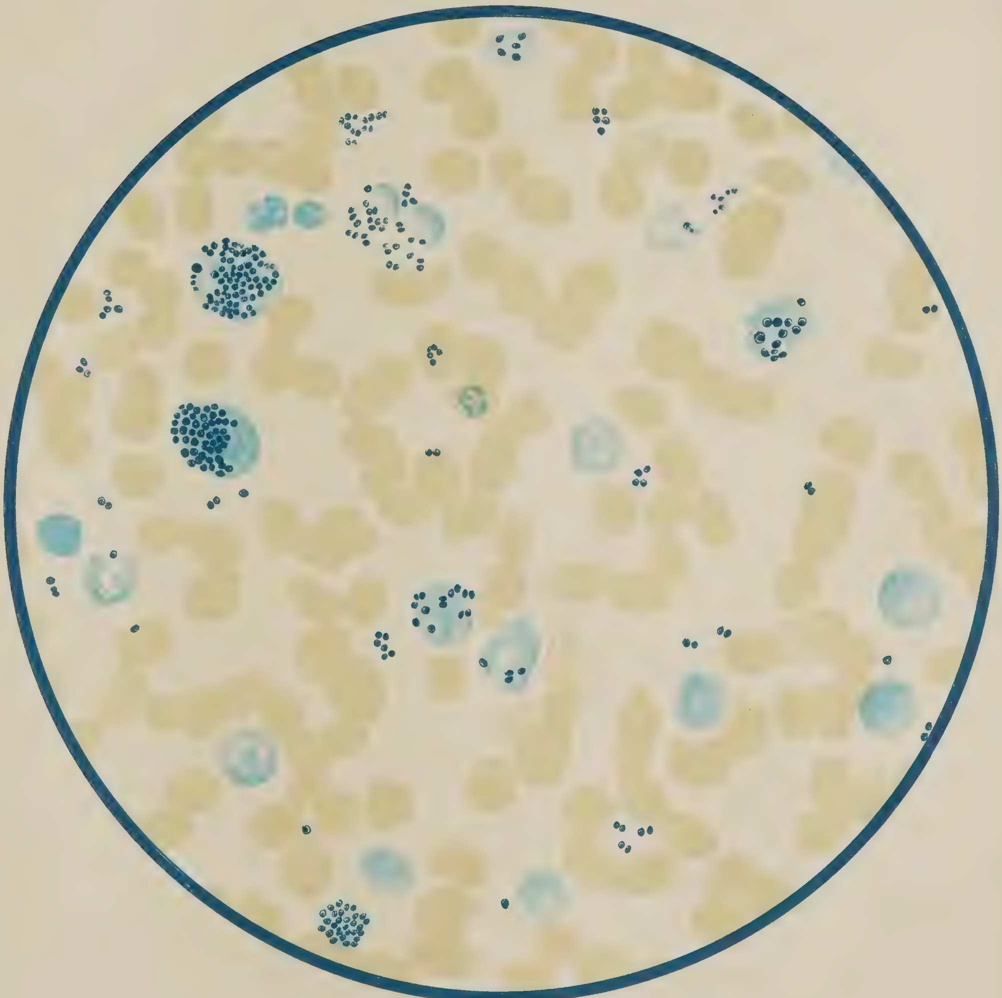
A REMARKABLE CASE OF SEPTICÆMIA.

By Lieutenant J. McKENZIE.
Royal Army Medical Corps.

Gunner P., was admitted into the Station Hospital, Calcutta, on October 17th, 1904, suffering from hyperpyrexia.

Personal History.—The son of a planter in Assam, his father had sent him into the Army for a time to "harden" him. He had two months' service, and his medical history sheet showed no previous illness.

History of Present Illness.—On the morning of October 17th patient had been out engaged in signalling practice. The sun was very hot, and towards afternoon he began to feel slight headache. The headache increased and was accompanied by a feeling of being very hot. At 6.15 p.m. patient reported sick at the Garrison Dispensary in Fort William. His temperature was found to be 106°, and he "complained of feeling hot and having a slight headache." He was given phenacetin and quinine, and a dose of mistura alba. Ice was applied to the head, and mist. diaphoretic given. Wet sheet packing was then employed, and the temperature reduced to 104°. At 8.30 he was sent over to the Station Hospital in a dhoolie. Admitted to the Station Hospital at about 9 p.m., his temperature was 101·8°. He ascribed his illness to having been out in the sun all the morning.



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The assistant surgeon on duty looked upon it as a case of malarial fever, several cases of which—both benign and malignant tertian—were being admitted almost every day from the fort. During the night he took nourishment well, the bowels opened three times, and he slept a little, though on the whole rather restless. Between 1 and 2 a.m. the temperature rose to above 103° and was reduced by sponging. This had to be repeated several times during the night, as the temperature constantly tended to run up. At 4.30 a.m. he became very restless, but nothing unusual was noticed. At 6 a.m he became slightly cyanosed, and the pulse was weak. At 7.30 a.m I found him markedly cyanosed, and breathing in a short, jerky manner.

On examination the area of cardiac dulness was greatly increased from dilatation. The heart sounds were weak, and the pulse could not be felt at the wrist. There were a few moist râles at the base of the lungs, slightly more marked in the left, but no very pronounced physical signs. The temperature was now tending to run very high, and had constantly to be kept down by sponging. Liq. strych., ♏viii., was injected under the skin, and quinine bihydrochloride, grs. xv. in solution, was injected into the gluteal muscles. Brandy, half an ounce, was given. The pulse could now just be felt at the wrist. The cyanosis increased, and it was noticed that the face and thighs began to show a pale purple blotchiness. The extremities were cold, and were treated with friction and hot bottles. It was noted that there were large patches of ringworm (often miscalled "dhobi's itch") on and near the scrotum; the raised edges of these had taken on a deep purple colouration.

Blood films were taken from the finger at 8 a.m. Under the microscope the wet film was seen to be swarming with small round bodies, apparently cocci. Many were free in the plasma, many were engulfed in the leucocytes, which also contained small particles of *débris*. Brownian movement was marked, and the cocci were so numerous as to give to the wet film an appearance something like the swarming of bees, or the restless activity of a colony of ants disturbed. The condition was now recognised as one of septicæmia, and the patient was re-examined for possible sources of infection. It was seen that mosquito bites on the legs and feet had been severely scratched, as had also the patches of ringworm on the thighs and scrotum. The result of this vigorous application of the patient's finger-nails had been the removal of innumerable tiny patches of skin, and their replacement by scabs of sero-pus. The feet were not very clean, and there was a deep crack on the plantar surface of the little toe of the left foot at the metacarpo-phalangeal joint. There was no other discoverable source of infection. The condition was similar to what is not infrequently seen in other men without bad results.

After the blood examination it was recognised that nothing could be done to save the patient. By 9 a.m. the cyanosis and dyspnœa had greatly increased, and the patient's condition was critical. No oxygen

was available. The purple colour on face and thighs had become deeper. The temperature tended constantly upwards, and it was necessary to use the wet sheet. Death took place at 10 a.m. on October 18th, sixteen hours after reporting sick. Less than twenty-four hours previous to his death the patient was in perfect health.

Post-mortem Examination.—External appearances already described. The whole body was now covered (four hours after death), with a diffuse pale purple blotchiness similar to that described on the face and thighs before death. There was no *post-mortem* lividity of dependent parts. The body was well nourished, and there were no marks of injury.

Heart.—Weight 10 ozs., contained a small amount of dark fluid blood in the left ventricle, which was hard and contracted. The right ventricle, which was soft and flabby, contained some pale blood clot. There were no vegetations on the valves, and no unusual appearances.

The *pericardium* contained about 2 drachms of serum.

Lungs.—Weight: right 1 lb. 3 ozs., left 1 lb. 6 ozs. There was slight congestion at the bases, rather more marked in the left lung.

Spleen.—Enlarged, and weighed $1\frac{1}{2}$ lbs.; dark on section.

Liver.—Weighed $4\frac{3}{4}$ lbs, normal in appearance.

Kidneys.—Each weighed 5 ozs. and appeared healthy.

Wet and dry films were taken from the peripheral blood both before and immediately after death, and wet and dry films were also prepared, during the *post mortem*, from the heart, lungs, spleen, liver and kidneys. As might be expected, all of these presented appearances exactly alike. The wet films have been already described. Stained with Leishman's stain, or with methylene blue, the dry films presented a remarkable appearance. Dotted all over the field were innumerable diplococci, sharply defined. Some were free in the plasma, large numbers were included in the leucocytes, some of which contained as many as forty diplococci. There was a very marked polymorphonuclear leucocytosis. The cocci, with few exceptions, were all in process of division and appeared as diplococci, an appearance not at first noticed in the unstained wet films. On re-examining the wet films, one could detect in some of the cocci the dim outline of the two diplococci, inside the perfect circle which all alike presented. Stained by Gram's method, the cocci retained the stain.

The Organism.—In considering the possible nature of the organism, four cocci only need be considered, viz., staphylococcus, pneumococcus, gonococcus, and the *Diplococcus intracellularis meningitidis* of Weischelbaum. Owing to the meagre equipment of the "District Laboratory," which does not possess such things as a hæmocytometer, a proper incubator, a centrifuge, a gas supply, or even an efficient microscope, it was unfortunately impossible to make cultures from the blood or sections from the organs, or even to make a proper blood count. It may be said to start with that there were no signs of gonorrhœa in this patient, and that cases of cerebro-spinal meningitis do not occur in this locality.

A ready method of preliminary differentiation exists in Gram's method of staining. The organism *retained the stain.* This at once excludes the gonococcus and the *Diplococcus intracellularis meningitidis,* so that there remain to choose between the pneumococcus of Fraenkel and staphylococcus, both of which retain the stain by Gram's method. Either of these organisms might be the cause of a general septicæmia such as existed in this case, but there appears to be two points on which a differentiation may be based: (1) In the pneumococcus there is a distinct capsule of appreciable size surrounding the diplococci; (2) in Fraenkel's organism the long axis of the diplococci lies longitudinally, while in the case of a dividing staphylococcus the long axis of the diplococci lies transversely.

In this case there is no appearance of a capsule, and the long axis of the diplococci lies transversely, so that Fraenkel's pneumococcus appears to be excluded. It would seem, then, that death in this case was due to a staphylococcic septicæmia, the rapid proliferation in the blood of a virulent type of staphylococcus, the only discoverable source of infection being the numerous small septic abrasions on the thighs and legs and feet, caused by the scratching of mosquito bites and ringworm patches. It would have been of the greatest interest to have determined, by making cultures, the exact species of staphylococcus, but unfortunately this could not be done for want of apparatus. The accompanying illustration by a native artist gives an excellent idea of the appearance presented by a film stained with methylene blue, one-twelfth inch oil immersion.

Remarks.—It is interesting to consider what the diagnosis would have been in the absence of microscopical examination of the blood. In all probability it would have been "heatstroke," less probably "ague" or "remittent fever." When one realises that even at the present day in India a microscope, at least in military hands, is an excessive rarity, it is open to speculate as to how many cases in India diagnosed "heatstroke," or, as Sambon calls it, "siriasis," have had their blood examined. Probably very few. In fact, it is even permissible to say that, owing to the absence of microscopes from military hospitals in India, the past statistics of malaria, enteric, malta fever, "simple continued fever" heatstroke, and all diseases, the correct diagnosis of which depends on examination of the blood, must be hopelessly inaccurate and misleading.

Sambon has asserted that siriasis is a germ disease, and in this he is supported in a tentative sort of way by Manson. Is this, then, a case of siriasis with its own particular germ? or, on the other hand, is siriasis in many cases merely a virulent staphylococcic septicæmia?

A CASE OF RECENT FRACTURE OF THE PATELLA, TREATED BY WIRING.

By Major C. E. G. STALKARTT.
Royal Army Medical Corps.

The operative treatment of recent simple fractures of the patella as a routine practice would appear to be *sub judice*. It is stated in Jacobson and Steward's "Operations of Surgery" that "the general opinion of the profession is against operation in such cases, owing to the good result which usually follows on non-operative measures"; also, "that much of the old dread of opening the knee-joint still survives." Doubtless the crux of the situation hinges on the question of asepsis being maintained, and Lord Lister, to whom the credit for the introduction of operative treatment is due, has very tersely expressed this as follows, viz: "No man is justified in performing such an operation unless he can be morally certain of avoiding the entrance of septic mischief into the wound." However, with modern methods this risk has been reduced to a minimum, and we find that in Cheyne and Burghard's recent manual of surgical treatment, the open operation is recommended as the best treatment for recent fractures of the patella.

The following case exemplifies the marked contrast between the result of operative treatment as compared to that usually obtaining in the treatment by the so-called palliative measures, when, after being in hospital from three to six months, the patient often lingers on for another six months before the limb is restored to usefulness.

No. 13489 Gunner B. was admitted to the Station Hospital, St. Helena, on June 16th, 1904. He gave the following history, viz.: While jumping off the emplacement of a six-inch gun, a height of about 4 feet, his jack-knife, which was hung on a lanyard, swung round and hit him across the knee; he fell to the ground and could not rise, and was taken to hospital on a stretcher. On admission, there was found a transverse fracture of the left patella, with one and a quarter inches of separation of the fragments; also a small chip broken off the inner angle of the lower fragment was detected, and the joint was tensely distended with effusion. The limb was temporarily treated on an inclined plane, and evaporating lotions applied over the joint. After five days the swelling of the joint had considerably subsided, but the fragments could not be approximated, one-third of an inch intervening between them, and it was decided to wire them together. Under chloroform, the joint was opened by a longitudinal incision to one side of the median line, all clots and effusion removed, and the joint irrigated with 1 in 6,000 solution of mercuric perchloride, the fragments drilled in the median line and thick silver wire passed through them. Before apposing the fractured surfaces the overhanging aponeurotic curtain was carefully raised and any tilting of the fragments corrected.

Union occurred by first intention and the dressing was removed on the eighth day, the joint being supported by wool and a light bandage. Movement of the limb was allowed in bed after the fourteenth day, and at the end of three weeks the patient was allowed to stand up and to bear some weight on the limb. Passive movement of the joint was begun and gradually increased. The patient was allowed up and to move about with the aid of sticks after the fourth week, and was discharged from hospital on August 30th, 1904, being then able to walk well without the aid of a stick, the muscles of the leg being in good tone and the movement of the joint very fair, though some stiffness remained, and was daily improving. The anæsthetic was duly administered by Civil Surgeon D. Ritchie, and I am indebted to Colonial Surgeon W. A. Arnold, who was kind enough to assist me at the operation.

FOREIGN BODY UNDER THE COSTAL CARTILAGES.

By Lieutenant-Colonel W. DICK.
Royal Army Medical Corps.

The following case presents features of interest from a medico-legal aspect.

A soldier, when bathing in a pond in Singapore, on May 19th, 1904, struck something hard whilst diving. He thought he had hit his chest against the root of a tree. He came sick the next day, with a small punctured wound of the chest between the fifth and sixth cartilages, half an inch to the right of the sternum. The wound was healed by May 26th. On June 7th the cicatrix broke down and commenced discharging pus, and a sinus was found to run underneath the sternum. The wound gave no definite indications on probing, but it continued to discharge. On July 10th, Captain Sheehan, R.A.M.C., the officer in charge of the case, had a consultation with Major Ritchie, R.A.M.C.; the man was given chloroform, the wound enlarged, and a piece of necrosed cartilage was removed. The wound, however, continued to discharge and the sinus persisted. On August 13th I went over to the island of Blakan Mati to see the man, and decided to open up the wound again. This I accordingly did on August 16th. The wound was thoroughly explored, but nothing was found; but as there was evidently something keeping up irritation, I cut through the sixth cartilage, and in a pocket behind it, found a piece of bottle glass triangular in shape with each of its sides rather over half an inch in length. The wound was thoroughly explored with the finger and nothing else found. In August the wound is still open, but seems to be in a fair way to healing. The gla-s was quite behind the cartilage and was not felt by the probe.

The interest in the case, I think, lies in the fact that had this man

been found drowned, it would have been a case in which foul play might have been presumed; as here was a man with a punctured wound of the chest, found at the bottom of a pond. Of course, a *post mortem* would have cleared up the case; but still the fact would have remained that he had been stabbed with a piece of glass and afterwards drowned.

NOTE ON THE ADMINISTRATION OF IPECACUANHA IN ACUTE DYSENTERY.

By Major R. J. WINDLE.
Royal Army Medical Corps.

Many of us who have served in India have an implicit belief in the efficacy of pulvis ipecacuanha in doses of from 20 to 30 grs. in the treatment of acute dysentery. The difficulty in its retention, the distressing vomiting and depression produced, are the great objections to its use. The following method of administration has been very successful in my hands, and I venture to bring it to the notice of my brother officers, who may not have tried giving it in this way. The patient, who has been kept without any fluids for two hours, is warned that he is going to have a sleeping draught, and that just as he is going to sleep he will be given a second draught.

No. 1.		No. 2.	
℞. Chloral hydrat. ..	.. gr. xx.-xxx.	℞. Pulv. ipecac. ..	.. gr. xx.-xxx.
Liq. opii. sed. ..	.. ♏xx.	Mucilag. tragacanth.	q. s.
Syrup aurant. ..	.. ʒii.	Aq. chloroformi	.. ℥i.
Aq. ad	.. ʒi.		

No. 1 draught is given, and usually takes effect in from ten to fifteen minutes. When the patient is just asleep he is sufficiently aroused to take No. 2. It must be shaken up in a phial and poured out just before being taken. In many cases the patient will, after this treatment, sleep from three to six hours, and wake without experiencing any inconvenience.

In some cases the ipecacuanha does produce sickness in spite of the chloral draught, but in these I have not known it to come on in less than one and a half hours, and in no case did the vomit contain ipecacuanha, showing that it had already been absorbed.

SARCOMA OF LIVER AND PANCREAS.

By Major C. W. R. HEALEY.
Royal Army Medical Corps.

The following case is of interest, owing to the fact that it is a condition very seldom met with; Osler states that Segre made 11,492 autopsies and only found sarcoma of the pancreas in two. He also states that primary sarcoma of the liver is very rare.

Private ———, aged 23, was admitted into the Station Hospital, Mandalay, on May 13th, 1904, suffering from sciatica on the right side, and was transferred to the Station Hospital, Meiktila, for change of air, on June 21st, 1904; it was stated in the medical notes accompanying him that jaundice began to appear about the middle of June. The patient stated that he had enjoyed good health until his admission into hospital with sciatica. There was no history of specific disease.

On admission into hospital at Meiktila he was very weak and somewhat emaciated, pulse varying between 90 and 100, and small; tongue coated, dry and brown; bowels obstinately constipated, with fæcal accumulations to be felt in the sigmoid flexure. The liver was enlarged downwards, the right lobe being a finger's breadth below the costal margin; whilst the left lobe was markedly enlarged, very hard, somewhat irregular on the surface, and slightly tender to pressure. He suffered from almost total anorexia, and slept badly, owing to the sciatic pain. He was kept in bed, and placed on a mixture of nitro-muriatic acid and nux vomica, and given a light and nutritious diet; various drugs were tried to get the bowels to act satisfactorily, but with little result; he could not retain an enema of soap and water or glycerine. Castor oil was the most efficacious purge, and the one he preferred. He suffered from retention of urine; this and the tendency to fæcal accumulation were both due to want of muscular tone, as no impediment to the passage of urine existed in his urethra. His temperature went up to 99° in the evening and was normal in the morning. He gradually lost ground, and became more emaciated daily. He had several attacks of vomiting, during which he brought up large quantities of fluid. Vomiting, however, was not a frequent occurrence, and it was easily controlled by the usual remedies. The jaundice became more intense, and the constipation persisted; the stools remaining clay coloured; the urine was extremely dark. The hepatic enlargement apparently remained the same; he did not complain of pain in this region, unless pressure was applied with the hand during examination. There was no ascites. The sciatic pain persisted throughout and was very severe, causing considerable wasting of the affected limb; it was treated with injections of morphia into the affected nerve; counter-irritation could not be adopted as he was only able to lie on the right side, owing to the sciatic pain.

On July 27th, 1904, his temperature went up to 101° and he was markedly worse. As his pulse began to fail he was placed on a mixture containing liq. strychnine; he was also given strychnine hypodermically. He, however, gradually sank, and died on July 29th, 1904, ten weeks after his admission to hospital. His temperature went up to 105·8° just prior to death.

Pathological Notes.—Body much emaciated and jaundiced. Lungs normal. Heart small, with thin walls. Liver somewhat enlarged, weighing 6lbs. On the surface of the left lobe and adjacent parts of

the right lobe, slightly raised, irregular patches of a light yellow colour were seen; these were extremely hard to the touch, as was also the adjacent liver tissue. On section these patches were whitish in colour, and extended down into the liver tissue, forming tumours, which varied in size from a gooseberry to a medium-sized potato; the large tumours had a tendency to be soft in the centre; there was no umbilication on the surface of these tumours. These growths permeated nearly the whole of the left lobe, and were also present in the adjacent parts of the right lobe. The remainder of the liver tissue was deeply stained with bile; the gall-bladder was distended with bile of a dark colour, and consistence of treacle. The pancreas consisted of a number of growths similar to those found in the liver; these were so numerous as to almost obliterate the normal pancreatic tissue. The stomach was normal, except for a number of small petechial hæmorrhages which existed in the mucous membrane along the greater curvature. The other abdominal organs were healthy.

A portion of the liver and pancreas were forwarded to the laboratory at the Station Hospital, Rangoon, and the specimens were examined microscopically and declared to be sarcomatous in character; the growths in the liver were chiefly of the large spindle-celled variety, and those in the pancreas of the round-celled variety, and in some parts mixed.

From the history of the case, the late development of jaundice and the slight inconvenience caused by the disease at the onset, I fancy the growth began primarily in the pancreas and extended to the liver.

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A CASE OF DOUBLE AND SIMULTANEOUS INFECTION BY THE ORGANISMS OF ENTERIC AND OF MALTA FEVER.

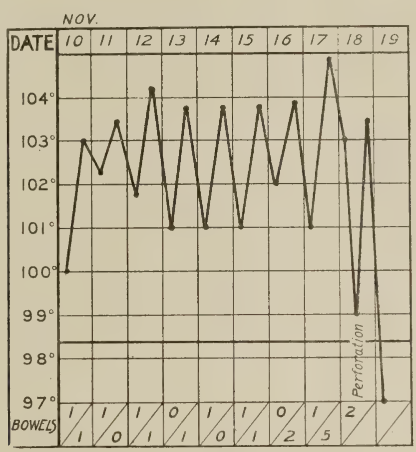
By Captain J. CRAWFORD KENNEDY.
Royal Army Medical Corps.

It has long been discussed whether it is possible to have a simultaneous infection by *Bacillus typhosus* and by *Micrococcus melitensis*. Undoubted cases have occurred where one disease has followed so closely on the other as to make one suspect that the infection was simultaneous; in these cases the blood serum reacts first to one disease and then to the other. In other cases the blood serum is said to react to both diseases from the first, but so far as I am aware there is no record of this being confirmed by *post-mortem* examination. I am now able to place on record a case in which both organisms were obtained from the spleen after death.

No. 9308 Acting Corporal B., Rifle Brigade, was transferred to my ward on November 13th, 1904, three days after admission to hospital.

History.—Admitted to hospital on November 10th, 1904, from Fort Manoel. He said that he felt unwell three days before, and complained

of pains in the head and back, some diarrhœa, and slight pains in the stomach. He had been under B. H. treatment for syphilis since June 6th, 1904, on which day he was discharged from hospital, where he had been under treatment from May 6th, 1904, for syphilitic ulceration of the tonsils and uvula. He arrived in Malta in April, 1904. No history of fever since his arrival can be obtained.



Clinical History.—From the first the patient presented a typical picture of a mild enteric. Bowels open once or twice a day, and the stools pea-soup in character. There was no tumidity, nor were spots observed. The blood serum was taken on the 13th, and tested for Widal's reaction. A dilution of one in ten was used, with a time limit of one quarter of an hour. Enteric gave an incomplete reaction, and Malta fever none. The case was clinically a straightforward enteric of a mild type, with no complications, and the blood serum was therefore not tested again. The complication of Malta fever was not suspected. Everything went well and the prognosis was excellent until November 17th (the eighth day in hospital), on which day he complained of pain, and some localised peritonitis was detected in the hypogastrium; there was also some tumidity. Next day (the 18th) perforation occurred, and patient died on the morning of the 19th.

Post-mortem Examination.—The *post mortem* was conducted twenty-four hours after death, and merely as a matter of course. Typical ulcers were found in the ileum, round the ileo-cæcal valve, and also in the cæcum, the majority having cast their sloughs and being well on towards healing. The ulcer which had perforated was situated 1½ feet from the ileo-cæcal valve. The spleen weighed 9½ ozs., and was preserved for bacteriological examination. There was nothing to be noted about the

other organs except that the liver was enlarged (febrile enlargement) and weighed 60 ozs.

Bacteriological Examination.—The spleen was seared and cut in three places, and cultures were made on six agar slopes, two from each cut, one loopful of spleen pulp to each tube. After incubating for twenty hours only one tube contained a growth, and they were all returned to the incubator. On examining them again, four and a-half days after, it was found that one tube contained no growth, one tube contained a growth resembling *Bacillus typhosus*, three tubes contained pure growths with all the appearance of *Micrococcus melitensis*, one tube contained *Micrococcus melitensis* and a slight contamination.

The following tests were applied to these organisms to prove them :—

(1) *Bacillus Typhosus.*—(*a*) The sub-culture on agar slopes, after twenty-four hours, appeared as a thin, moist, translucent greyish-white growth. (*b*) It emulsified readily in normal saline solution, and under the microscope appeared as a short motile rod. (*c*) It did not retain Gram's stain. (*d*) It was agglutinated by serum from an enteric fever case, diluted to 1 in 200. (*e*) It grew on glucose litmus agar with slight acidity. (*f*) It grew on potato with characteristic snail-track appearance. (*g*) In lactose medium no gas was produced. (*h*) After eight days' incubation in litmus milk no coagulation was produced, and slightly less than 5 per cent. of acid was found after testing with $\frac{N}{10}$ alkaline solution. (*i*) In Witte's peptone and salt solution, after incubating for seven days, it produced no indol when tested for by means of potass. nitrite solution and sulphuric acid ; on standing over-night a faint rose tint was observed.

(2) *Micrococcus Melitensis.*—(*a*) It had taken four days to appear in the tubes. (*b*) It emulsified readily and appeared as a tiny coccus. (*c*) It did not retain Gram's stain. (*d*) It was agglutinated by monkey's serum, diluted to 1 in 2,000. (*e*) Sub-culture on agar slope was typical. (*f*) No acid was produced on glucose litmus medium. (*g*) No gas was produced in lactose peptone medium. (*h*) In litmus milk, after incubation for a week, there was no coagulation and there was a very marked alkaline reaction.

There can, therefore, be no doubt as to the nature of the organisms isolated from the spleen ; and the double infection is conclusively proved. It remains to determine the probable date of infection, and to prove that they were as nearly as possible simultaneous.

The Infection by Enteric Fever.—Judging from appearances found at the *post mortem*, the disease must have been well on in the third week (say the twentieth day). That would make the first day of invasion about October 30th. Taking ten to fifteen days as the accepted period of incubation, the infection must have been contracted between October 15th and 20th.

The Infection by Mediterranean Fever—The following facts go to prove that there was no previous infection by Malta fever : (1) Nothing to sug-

gest it in his previous medical history; (2) the man's own statement that he had been perfectly well up till three days before his admission to hospital; (3) negative Widal's reaction to Malta fever on the 13th, the supposition being that a reaction would have been present had he been previously infected by Malta fever.

We have therefore three facts to work on: (1) No previous infection; (2) negative Widal's reaction on the 13th (six days before death); (3) the proportion of *Micrococcus melitensis* to *Bacillus typhosus* found in spleen :: 4 : 1.

Putting aside all theories and suppositions as to the hiding of the agglutinating reaction in double infections, we will suppose that the 13th was not yet the fifth day of the disease (because one usually reckons on obtaining a reaction on the fifth to the eighth day of invasion), but taking into account the cultures obtained from the spleen six days after, it could not be far off it. We will say, therefore, that November 13th was the fourth day of invasion. Calculating from this, and allowing fifteen to twenty-one days as the incubation period for Mediterranean fever, we are brought back to the period between October 18th and 24th as the probable date of infection by the *Micrococcus melitensis.* This corresponds very closely to the date of infection by the *Bacillus typhosus*, and therefore for all practical purposes we may say that the infection was simultaneous.

There is one very interesting point in this case alongside the one of double infection. I mean the fact that Widal's reaction to Malta fever was negative in a dilution of 1 in 10, and yet, six days after, abundant growth of *Micrococcus melitensis* was obtained from the spleen, and at the same time the *Micrococcus melitensis* was more abundant than the *Bacillus typhosus* (presumably a more rapid-growing organism) which had given an incomplete reaction. I much regret that no repetition of Widal's test was performed, but there was nothing in the clinical aspects of the case to suggest it.

This raises the very interesting and extremely difficult question of what effect a double infection by two such diseases has on the body's resistive powers, as evidenced by Widal's reaction. At this time I dare merely to touch on this, and that with some diffidence, but do so because, though short has been my experience, I know that much is to be learned from this aspect of double infection, and that any contribution to so interesting a question is worth recording.

Two other points I should like to draw attention to are in connection with the previous medical history of the case: (1) He was suffering from syphilis and had been under treatment by mercury for some months. This had undoubtedly some effect in lowering the body's resistance. One of the most acute out of half-a-dozen cases of the meningeal type of Malta fever that I have seen was that of a man with a similar history. Whether it is the syphilis or the mercury, or both factors working to-

gether, that have this effect, I cannot discuss in this paper. (2) He had ulceration of the tonsils and uvula. It has always been my idea that the tonsils are a very likely point of entrance for infection of Malta fever (see ROYAL ARMY MEDICAL JOURNAL, April, 1904, page 501).

This is only one of several cases that I could bring forward with a distinct history of previous inflammation of the throat or tonsils.

I do not apologise for bringing this case to notice, because apart from the fact that I believe it to be the first time that the two organisms have been isolated from the same spleen, I consider that it is extremely important to recognise that the two diseases may exist together, especially in view of the treatment. In such cases the serum diagnosis is not absolutely to be relied on, and it is quite possible to imagine a case treated as Malta fever in which the enteric may have been masked until it evidences itself by the fatal results of a too liberal diet.

Philosophy, Travel, &c.

RANIKHET AND THE DISTRICTS OF KUMAON AND GARHWAL.

By Lieutenant-Colonel C. E. NICHOL, D.S.O.
Royal Army Medical Corps.

A description of this popular and important station, where so many officers of the Corps get an opportunity of serving, may, I think, prove of interest to your readers.

The physical aspect of the Himalayas may be roughly divided into three divisions, and I take the following apt description of these from Crooke's "North-West Provinces of India": "First we have the outer Himalayas, with a height of from 5,000 to 8,500 feet, which rise abruptly from the lower plain, and then sink sharply to the north into deep and narrow valleys. Here the clouds rising from the ocean first strike the mountain barrier, and produce an excessive rainfall, the general average being from 80 to 90 inches; about the same as that of the Scottish highlands, but all concentrated within little more than a quarter of the year. There is little arable soil, and the climate, except on the breezy summits of the hills, is malarious and unhealthy; population is scanty, and the country is mostly covered with dense forest. Behind these heights are lower hills and wider valleys, receiving a rainfall little more than half that of the outer barrier. Here population is more dense and cultivation more extensive. Behind these, again, are the giant peaks and higher valleys, which during the winter are impassable from snow, and in the summer are inhabited by a scanty nomadic population." It is in the second of these divisions that Ranikhet is situated, in latitude north 29° 38′, longitude east 79° 29′, on a pine-clad ridge of the Kumaon Hills, 6,069 feet above sea-level, and distant by road and rail 104½ miles from the well-known cantonment of Bareilly. Kumaon, the district in which it lies, has an estimated area of 3,680,000 acres, or 8,000 square miles, of which only about 200,000 acres are cultivated, and is bounded on the north by Thibet, on the east by Nepaul, on the west by Garhwal, and on the south by the malarial belt known as Terai, and which separates it from the plains of India. The terminal station of the Rohilkhand and Kumaon railway, which starts from Bareilly, is

Kathgodam. It is fifty-four miles from Bareilly, and is situated at the foot of the hills, and a good cart-road, 50½ miles in length, connects it with Ranikhet.

Ranikhet is the hill station of what has hitherto been known as "The Rohilkhand District," but, as I write this article, the designation has been changed to that of "The Bareilly Brigade," and henceforth will form one of the Brigades of the 7th or Meerut Division of the Eastern Command, under Lord Kitchener's new redistribution scheme for the Indian Army. The Brigade is under the command of a Brigadier-General, who, with his staff, resides at Ranikhet during the season, *i.e.*, from March to November. Ranikhet, with the adjoining hill of Chaubuttia, which is about 1,000 feet higher, forms one station, and is under the command of the senior officer; similarly, the Senior Medical Officer, Ranikhet, is *ex-officio* Senior Medical Officer of Chaubuttia for sanitary duties.

Chaubuttia is distant five miles by cart-road, and three miles by pathway and pony track, and has hitherto accommodated the headquarters and wing of a British regiment, but is only occupied from March to about the middle of November, when the troops return to Bareilly. Extensive additions to the barracks have just been completed, and this year it is proposed to locate a whole battalion here. It possesses its own Station Hospital, under command of a Major, R.A.M.C., and will have accommodation for 108 beds, inclusive of women and children. Ranikhet itself affords accommodation for a full battalion at the Kumpoor barracks, which consist of single-storied buildings, with the exception of one block, which is double-storied, and almost a whole battalion is located at what is known as "The Standing Camp," which consists of single-storied barracks only.

In addition to these there are numerous detached blocks of married quarters, which accommodate about eighty families of other units in the command. These are always fully occupied during the summer months, or rather the season, which is reckoned from the beginning of March till about the middle of November. During the remainder of the year the garrison consists of one company, and perhaps the married families of one or two regiments, accommodation for which may not be available at Bareilly during the winter months. The strength of the garrison in 1904, exclusive of Chaubuttia, was approximately as follows:—

From January to February	170
,, March ,, November	1,800
,, November to end of year	100

and excluding married families previously mentioned.

Chaubuttia has its own Station Hospital, as already noted. The Station Hospital, Ranikhet, consists of one main block, facing north and south, and commanding a magnificent view of the snowy range, and two similar detached blocks facing east and west, together with a separate Station Family Hospital and detached buildings for infectious diseases, for men and women. The site is a well-chosen one, and there is an extensive flower garden, which contains some very fine specimens of the deodar (*Cedrus deodara*). The accommodation is for 214 beds during the season, which is reduced to 108 during the winter months. All the blocks are single-storied. The surgery, medical store-room, medical officer's rooms, &c., and hospital store-keeper's godown are all detached from the main building. It is under the command of a Lieutenant-Colonel, and he has under him three junior officers during the season, and occasionally one during the winter months. There is the usual complement of assistant surgeons and Army Hospital and Bearer Corps, and, in addition, during the season, three sisters of Q.A.I.M.N.S.I. are stationed here for duty.

At the Standing Camp there is a detention hospital of eight beds, but the sick are all treated in the Station Hospital, Ranikhet. There is a first-class General Cantonment Hospital for the followers and native population, and this appointment, as well as that of Staff-Surgeon, is held by a R.A.M.C. officer.

The general health of the troops is satisfactory, though in past years there has occasionally been a severe outbreak of cholera. This has generally been traced to the pilgrim traffic to the holy shrines of Badrinath and Kedernath in Garhwal, stragglers from which come back through the station annually. Up to last year the water supply had been from certain springs which were protected, but as the supply used invariably to run short in the summer months, other springs, not so well protected, had to be taken into use; and certainly the epidemic of 1903, which caused the death of one officer and seventeen men, was due to one of these surplus springs becoming contaminated. Cholera, at the time, was raging in the adjoining tehsil of Almora and Naini Tal, and gradually encroached up to the villages surrounding cantonments. A strict cordon was drawn round the bazaar and infected barracks and the regiment scattered out in surrounding sanitary camps. Both other regiments in the station escaped infection. There was a similar outbreak in 1890, I believe, in which Surgeon-Captains Renny and Cronin, two promising young officers of the Corps, lost their lives. This year, 1904, for the first time, there is a properly laid-on pipe

supply of excellent water, from what are known as the Nag springs. These are situated about three and a half miles beyond Chaubuttia, far away from any village or other sources of contamination. There are seven springs altogether, which are carefully protected by barbed wire entanglements, and the water is pumped up by powerful engines. The yield of the springs in the wet season is 110,000 gallons a day, and during the dry weather 64,000 gallons, and this is now piped on to Chaubuttia, Kumpoor Barracks, Station Hospital, Ranikhet, and all detached married quarters, and has already proved an inestimable boon, and had an excellent effect on the health of the troops. Private bungalows in the station have also the benefit of this supply. The Standing Camp last year drew its water supply from what are known as the Chupra and "X" springs; this was invariably boiled before use, and always yielded satisfactory analysis; but this year it is contemplated also to supply it with a pipe supply from the forest spring beyond Chaubuttia.

The water supply of Ranikhet up to last year had always been the great difficulty, both as regards its scantiness and liability to pollution, and future years will in all probability show a very marked improvement in the general health of the community. In past years Ranikhet has also acquired rather an evil reputation from the extensive prevalence of that somewhat mysterious disease "hill diarrhœa"; this, I am of opinion, was also largely due to the impure water supply, and it is satisfactory to note that last year, for the first time for many seasons, the cases have been very few indeed.

Enteric Fever.—There are usually from twenty-five to thirty cases during the year—about one-third of these are probably contracted in the plains or on the line of march, and develop within a short time on their arrival in the station. The remainder are undoubtedly contracted in and around the station, and here, again, I consider the source of many of the cases is impure water drunk down the khud sides when out catching butterflies and shooting, &c.

One severe case of a young officer last year was traced to his drinking water whilst out shooting, immediately below a native village. The cases as a rule are fairly mild, and with few complications. Last year there were twenty-four cases and two deaths.

Malarial Fevers.—These are all imported cases. There are a few mosquitoes to be found in the hot months, but these are all of the *Culex* breed. I have never found any *Anopheles*. I have met with very severe cases of ague, however, in the low-lying hot valleys in the district amongst missionaries and the native popula-

tion. The *Anopheles* in these cases probably breed in streams and running water.

Other diseases call for no special comment.

The climate of Ranikhet is essentially a salubrious one. January is perhaps the most disagreeable month, raw, cold, and often ushered in with snow and hailstorms, that make one fully appreciate the benefits of a good log fire. February is also a cold month, but a distinct improvement on January. March is a very pleasant month—pleasant, sunshiny days with a cold wind. April, May and June the temperature gradually increases, but the heat is never unbearable and punkahs are never required. The monsoon is ushered in by loud and frequent thunderstorms, and generally breaks about the third week in June, and from then until the middle of September there is a rainfall of about 50 inches, and for days and days together the hills are often shrouded in mist and fog, and altogether the general condition is one of "dampness." The rains cease about the third week in September, and from thence on to the end of the year the weather is as near perfection as possible. October and November are perhaps quite the pleasantest months, cold, bracing, and exhilarating, with bright sunshine—days that speed only too quickly and makes one grudge all the time spent indoors. These are the months *par excellence* for shooting and fishing and making various pleasure trips to places of interest in the district. December, too, is a pleasant month, but often bitterly cold at night. I have compiled a table (see Appendix) from meteorological returns, which gives full details regarding temperatures, &c.

Ranikhet, as I have stated, is placed on a pine-clad ridge, in fact, it may be described as situated in the midst of the great Chir pine-forest. The Forest Survey shows the forest area in Kumaon to be 433,951 acres, and in British Garhwal, the adjoining district, over half that amount again. The Chir pine (*Pinus longifolia*) is peculiar to the Himalayas and has a very extensive range. The area of Chir alone is over 150,000 acres, and the number of measurable trees per acre is about twenty-eight, divided into first, second, third and fourth classes respectively, besides seedlings. The first class trees are over 8 feet in girth—some have measured 14 feet in girth and 140 feet in height. The age of such a tree is computed from the rings to be over two hundred and fifty years. The timber is beautifully grained and is strong and durable, is full of turpentine, but is chiefly used for fuel. All the roads and paths of the lower hills up to 6,000 feet pass through miles and miles of this Chir pine, and the ground is covered with slippery pine-needles, shed in the

Fig. 1.—Amongst the Chir pines at Ranikhet.

spring season, so that walking is very tiring, and the feathery tops afford only very scanty shade. The Chir pine is the predominating feature of Ranikhet; other trees growing on the hills are the Himalayan cedar or deodar (*Cedrus deodara*), a very beautiful conifer, the wood of which is the most valuable of all the *Coniferæ* for housebuilding, boats, railway sleepers, &c., the timber being little affected by extremes of heat and cold, and is most durable; the blue gum tree (*Eucalyptus obligna*); the rhododendron (*Rhododendron arboreum*), the blooms of which in the month of March present the most brilliant colouring, and are never forgotten by those who have seen them; the cypress (*Cypressus torulosa*); the ash (*Fraxinus floribunda*), the wild pear and cherry, the willow, and three or four varieties of oak, the chief of which is *Quercus incana*. This latter is the next commonest tree to the Chir pine. There are many others in addition to the above to be found, but it is not necessary to mention them here. The holly bush, calling back memories of Christmas in the old country, is quite a familiar sight, and the dog roses, blooming in the summer months, together with the dahlias in every variety of hue in the autumn, are a constant source of delight to the "memsahibs." Though the flora of Ranikhet is, taken on the whole, beautiful, it is not comparable to that of the higher ranges, where magnificent forests of oak, chestnut, spruce, and birch replace the Chir pine of the middle ranges. There the botanist, as well as the ornithologist, entomologist, geologist, archæologist, or almost any other "ologist," can revel in his hobby to his heart's content. In over fourteen year's service in this country, during which a large portion of my leave has been spent in shooting trips and wanderings in these hills, I must confess they possess to this day for me as great a fascination as when I first made their acquaintance; and, again, I often hope to wander in distant Garhwal, far off the beaten track, camping in those noble forests, and midst scenery which for grandeur is unsurpassed in the world.

The bungalows in Ranikhet are not too numerous, but suffice for the married residents. They are substantial, stone-built structures with iron roofs, and very comfortable. The rents vary from 600 to 1,400 rupees for the season, and compare favourably with those of other hill stations. Some of these possess quite good vegetable and fruit gardens, and many of them command a splendid view of the snowy range. Some of them are double-storied, but the majority are single-storied. The cantonment is an extremely well-kept one, and is one of the few hill stations where

it is possible to drive a trap, and where such a vehicle is really useful. There are many charming rides also through the forest in all directions. The clothing worn by the troops throughout the season is khaki drill, but serge is required for the winter months, and good English tweeds are most useful, and also the puttee cloth made in Kashmir. Supplies are nearly all brought up from the plains. The beef and mutton are of excellent quality, considering the scanty grazing. The sheep are always brought up from below, as well as ducks, fowl, quail, &c. Nearly all the English vegetables —cabbage, cauliflower, potatoes, beans, peas, beet, &c.—are grown in Ranikhet, and, in addition, excellent apples and pears, apricots, cherries, and mulberries are obtainable in due season, and during the winter oranges are brought in from the neighbouring districts. There are three large shops, one kept by a European, a second by a Parsee firm, and a third by a native merchant, where supplies and stores of every kind are always procurable, quite fresh, and at reasonable prices. Messrs. Rustomjee and Sons have been established for many years, and do a very large business; in fact, they are quite the "William Whiteley" of Ranikhet, and are always most courteous and obliging to their customers.

The milk supply to the Station Hospital is given to a contractor, who has had it for several years, and he has his cows in sheds on the khud side below the hospital, where they are under the personal supervision of the Senior Medical Officer; in addition, an old guard-room, a detached building in the hospital compound, has been fitted up as a dairy, with separators, &c., and many modern improvements. This is inspected daily and at any hour by a medical officer, and has been found to answer its purpose admirably. The majority of resident officers and their families are supplied with milk, butter and cream from this source in their own locked tins, and complaints as to quality are very rare indeed.

The Standing Camp regiment, the regiments quartered in Kumpoor and at Chaubuttia, have all their regimental dairies and cows under careful sanitary supervision.

A certain amount of butter for the troops is obtained daily during the season from the plains, supplied from Aligarh and other well-known dairy factories.

Last season, for the first time, Messrs. Smith, Rodwell and Co. have been running "tongas" through daily to Kathgodam. The fare is 15 rupees, and the journey takes about nine hours up and seven going down. It has proved of great benefit to residents and other travellers passing through on shooting expeditions, &c.,

in addition to all the young officers who are detailed to attend garrison classes at the station, and will, probably, become a regular institution in future years.

The games played in the station are polo, cricket, football, hockey, tennis and golf. Polo is now played on both the Kumpoor and Standing Camp parade grounds, but the game is generally three a side. There is an excellent station club, to which have been added this year a large ball-room, with a floor on springs, and concert-room, new card-rooms, &c. Here there are several tennis courts, which are crowded every day during the season. The ancient and royal game has many enthusiastic votaries. There is an excellent course of nine holes, laid out at Upat, a few years ago, by that well-known sportsman, Colonel Parkinson, lately commanding the 1st Hampshire Regiment, and for this we all owe him a debt of gratitude. Upat is about four miles distant along the cart-road to Almora, and is in itself a delightful spot, and in high request for picnics, luncheons and gymkhanas. With its grassy spaces and wooded glades one might, except for the Chir pines, imagine one's self in some well-kept English domain. I look upon the golf links as one of the most powerful of Ranikhet's many attractions.

To attempt here a description of the glorious view of the snowy range of the mighty Himalayas requires a much more graphic pen than mine to do it justice. One's first impression is one of awe and delight at such unparalleled grandeur. Imagine a long chain of stupendous mountain peaks of dazzling whiteness, the highest seen from Ranikhet being Nanda Devi, over 25,000 feet, and 9,000 feet higher than any summit in Europe, stretching right across the horizon as far as the eye can see. It is during the winter months, from October to February, that the finest views are obtainable; during the hot months they are completely hidden from view by a thick atmospheric haze, and in the rains are wrapped up in dense mists, and only when the clouds lift, after a passing thunderstorm, do we catch a flashing and momentary glimpse of the snows. Trisúl, with its triple peaks, is the most prominent of the group. Nanda Devi, noted above, with its brother peaks of Nanda Kôt, Moo Gobin and Trisúl, extend over 1,400 square miles, or 920,000 acres of the survey maps. From its great masses of snow-fields the Niti, the Rishi, the Pindar, the Trisúl, and other glaciers descend. The inter-alpine valleys of the snowy range are known by the name of Bhot, which term is rather ethnographical than geographical, and signifies the tract occupied by the Bhootiyas. This includes the districts bordering on Thibet, Byans, Darma and Chaudans on the East, Júhar in the middle, and Painkhanda on the west.

The chief places of interest in the vicinity of Ranikhet are Almora and the Pindar Glacier, Naini Tal, and the Kumaon Lakes. The archæologist will find Dwarahat, 12 miles off, well worth a visit, and the geologist, botanist and sportsman will find, indeed, plenty to interest him in the neighbouring district, Garhwal. The glacier of the Pindar River is a very favourite trip, and many visitors go there annually. It is not a difficult one, and there are bungalows available for accommodation the whole way. A most convenient starting-point is Almora, which can be reached in three or four

Fig. 2.—A "bit" in the higher ranges.

marches from Kathgodam. From here the distance is seven marches, or 75 miles, but the journey, of course, could be lessened by doing double marches. It is generally undertaken in the spring or autumn. In the former the scenery is at its best and strikingly beautiful on all the hill sides in the gorgeous bloom of the rhododendron. There is some stiff climbing to be done in parts, and the scenery in places is very fine. Those who are keen on shooting and fishing generally prefer the autumn trip; chuker, mooral and gooral can generally be got *en route*. Almora, 19 miles by short cut, 28 miles by cart-road, from Ranikhet, and 30 miles from Naini Tal, is built on a bare, saddle-shaped ridge, running north-west to

south-east for about two miles, with an elevation of from 5,200 to 5,500 feet above sea-level. It is surrounded on all sides by higher ranges, which protect it from storms. The rainfall is 40 inches, and 60° F. is about the annual average of the temperature. It is very hot from May to end of June, the temperature then being only about 15° cooler than that of the neighbouring plains. In the rains 72° F. is the average temperature, and the range rarely varies 2° in the house night and day. In the summer months there is always a thick haze, which is common to all the surrounding hills, and shuts off all views of the snowy range. From its dry, equable temperature it is considered an excellent place for the treatment of lung affections, but for other invalids it is rather relaxing than otherwise, and the heat is enhanced by the total absence of shade. The hillside is quite bare of any trees. The water supply is good.

The capture of Sitoli, where a decisive battle was fought in 1815, resulted in the defeat of the Ghoorkas and the cession of the whole division to the British. The leading part in this local Kumaon War, under General Ochterlony, was taken by Lieutenant-Colonel William Gardner, afterwards Lord Gardner, of Anglo-Indian fame. Those were the days when De Boigne and Perron, the Savoyard and Frenchman, had reached their zenith, and when George Thomas, Claud Martin, Gardner, Skinner, and many another "free lance in a foreign land," carved their way to fame and fortune. Truly stirring times for any soldier with a spirit for adventure.

Almora is now the permanent station for that distinguished regiment, the 2/3rd Ghoorka Rifles, and any one wishing further information about it, I can only refer him to those delightful leaves from a hill journal, entitled "Almoriana," written by my friend "V."

Dwarahat, twelve miles from Ranikhet, is a picturesque little place, situated on a plateau at an altitude of 5,200 feet; the plateau is several miles in extent, and is well watered and surrounded by low hills, and is a favourite manœuvring ground for the troops. The remains of many ancient temples lie scattered about in groups in the surrounding fields. They are of the usual pyramidal form, ornamented with some simple moulding, and surmounted by an ornament resembling a "Turk's cap." They are mostly in ruins, having been desecrated by the Rohillas when they invaded this part of Kumaon. The palace of the old Rajas was built on the rock called the Tharp, and just below it is the bazaar. The most important temple now in use is the Badrinath. It comprises some of the

older temples, enclosing a courtyard, much frequented by pilgrims. One of the images bears a date corresponding with our A.D. 1048. There are many other old temples, mostly in ruins, some dating back to the eleventh century; only about half-a-dozen temples are now in use. The place was a considerable centre for trade in the olden days, but its importance has now much diminished. At present it boasts a school, dispensary, a dak bungalow, and a large colony of native Christians, under the direction of some missionary ladies.

The Kumaon Lakes are known as Naini (6,407 feet above sea-level), Bhim (4,500 feet), Naukutchiya (4,000), Malwa (3,400 feet), Sath, and others, with the affix "Tal," or lake, attached. They are a favourite resort of visitors, and their existence has been assigned to landslips which closed up the valleys in which they occur. They certainly form one of the most remarkable and beautiful features of Kumaon. The Naini lake, of wide-world fame, is about 1,500 yards long by 400 broad, and with an average depth of 40 feet. It lies in a valley which runs north-west and south-east, and is surrounded on all sides, except the east, by the lofty ridges of Sher-ka-danda, Cheena, Deopatha, and Ayarpatha. It is not necessary here to attempt to portray the fascinations and attractions of this charming station, the summer headquarters of His Excellency the Governor of the United Provinces of Agra and Oudh, and also of the Lieutenant-General commanding the Eastern Command; suffice it to say there is a capital boat club, with an average roll of about 100 members. There are a great variety of boats, racing fours, pairs, and skiffs, to say nothing of wherries and canoes. Most of them are built at Henley. There are also several sailing boats, and the course is about six miles. Rowing and sailing regattas are held every fortnight during the season, and there is always great excitement during the famous "Ranikhet Week," at the beginning of June, when teams from both stations compete at all games.

(*To be continued.*)

THE ORIGIN OF LIFE.

III.

By Lieutenant-Colonel BRUCE SKINNER.
Royal Army Medical Corps.

The past history of life upon the earth is being constantly made more clear by the accumulation of facts relating to the composition and the relative sequence of the rocks, as well as by the discovery of life-forms in localities which have hitherto been but cursorily inspected, or have even altogether remained, until recent years, without the ken of science. The geologist has carefully studied the sequence of the sediments, working out their relations to each other by their physical positions, as well as by the evidence afforded by their fossil contents. The palæontologist has elucidated the nature of the fossils produced from the rocks, whatever their age or the locality from which they have been obtained. But in spite of the fact that every year is adding to the sum of knowledge in these respects, the record of the succession of life-forms is not yet complete. Commencing, as we are about to do, at the bottom of the series of the known sedimentary rocks, we are, at the very outset, faced with an instance of the deficiency in the material required to exemplify the origin of life.

The unravelling of the history of the earliest known sedimentary rocks has been one presenting the greatest difficulties. Those sediments have been so crushed and distorted and changed by pressure and heat that such traces of life as they doubtless once contained, at least in some localities, have been, to a great extent, rendered unrecognisable; consequently, but few fossil remains have been recovered. Even though those sediments which can be proved to underlie the strata which will be presently mentioned under the name of "Cambrian," are not indubitably the earliest deposits, yet they are the earliest known up to the present, and they will serve the purpose of this sketch, as they are obviously of earlier date than the Cambrian, and have furnished us with some life-forms.

The difficulty of tracing the earliest forms of life in the strata of the earth's crust will be readily appreciated by those who are familiar with the least developed forms of the present day, such as bacteria, lichens, fungi, and many of the protozoa, porifera and animals, as well as plants even higher in the evolutionary scale. But though the actual forms cannot be discovered, their presence may be inferred, for the products of life-action and of decay must have

been similar, in the case of the earliest forms of the past, to those being produced by living things of the present. Limestones and certain siliceous rocks are known to be in course of construction, through the agency of protozoa and algæ, whose life-processes involve the extraction of lime and silica from water containing those materials. By these means immense beds of limestone and chert have been laid down in the ages marked by strata known to be fossiliferous, and presumably, therefore, in ages whose deposits have not as yet yielded fossils.

Carbon, where found as coal and graphite, has taken its present condition as the result of the decomposition of vegetable matter, by which it had been assimilated during life from carbon compounds in the air, soil, and water. Besides the deposits, composed mainly of carbon, we also, in sandstones, shales and limestones, observe a coloration, due to a mixture of carbonaceous material with their other constituents. This is attributable to accumulation of the detritus of vegetation in the water within which such rocks were laid down. Further, in arid countries, where blown sand has covered over patches of vegetation, we find the site of the latter marked by a carbonaceous deposit, which contains, after a time, no trace of the form of the vegetation from which it arose.

The deposits of bog-iron ore, so largely developed in the rocks preceding the Cambrian, in Canada, have been attributed to the action of diatoms and of decaying organic compounds.

Such deposits as those instanced above do not always contain fossil evidence of the animals or vegetables to which they owe their existence. Various physical processes have been the means of destruction by heat, pressure, solution, or chemical transformation of such fossils as may have been present. But, arguing from the knowledge we possess of the method of formation in the present day of similar rocks, we may deem it not unlikely that some, at least, of the vast masses of the earliest known (pre Cambrian) limestones and all the graphite beds may have been produced by agencies such as are now operating.

The largest accumulations of fossil deposits have been laid down in water, and usually in sea or brackish water. Limestones represent the deposits of deep water, whether marine or lacustrine; sandstones are generally deposits of sea-margins. Gravels are brought down by rivers; conglomerates are lacustrine; while mudstones and shales are estuarine.

There is no hard and fast line in the above definitions, which must be accepted as general guides. For intance, the deposits of

the estuary of the Thames bear no comparison as to the depths of water in which they settle down in relation to the deposits of the Amazon, carried as the latter are at times 300 miles into the Atlantic.

From the beginning of the time when the rock material composing the first-cooled earth-crust commenced to break up the *débris* was removed, chiefly by water. With the *débris* terrestrial life-forms were carried. These were deposited layer upon layer. When by means of physical causes the earth's crust was distorted, or disturbed, the original position of the above sediments was altered, so that sometimes the sediments became converted into land surfaces. As soon as that happened the new land became subject to waste from the many causes which induce crumbling of the rocks. Denudation (or removal of *débris*) has left its mark on such old land surfaces as have been lowered subsequently beneath the sea-level, even though they have later been covered over with sediments; they can be recognised as former land (provided they have been again raised and exposed to view) by the irregularities of surface occasioned by the carving out of stream-beds, &c. These processes have been ceaseless, the result to-day being the rocks as we see them. But between our land surface and the earliest rocks is a vast period of time, during which sedimentation somewhere or other has always been forming rocks. These rocks have been studied and systematised; names have been given to groups of them, and in the remarks which follow these groups will be cited as "land-marks," and will be called by the names given to them by British geologists. As they are dealt with in chronological order, commencing from the bottom of the series, that is, the earliest, it is not necessary now to enumerate them. The groups are divided into sub-groups, but as far as possible mention of these sub-groups will be avoided, and relative position will be indicated by the words lower, middle, and upper.

With these preliminary remarks we may pass on to consider the earliest known sedimentary rocks, which have been named Pre-Cambrian.

They are composed of sandstones, limestones and shales, with deposits of graphite and iron ore. The strata may be placed in two series. The rocks representing the lower series have been much crushed, distorted and displaced. They have been extensively altered in their physical properties by these processes, as well as by heat and pressure. They have, further, been denuded, and this denudation occurred before the upper series was laid down. They have yielded no direct evidence of the existence of life-forms.

The immense beds of graphite present in this series are the nearest approach to a suggestion of life-forms connected with land; but there is no indication of those physical conditions necessary for the existence of land flora or fauna. Until a locality presenting such conditions has been found it is necessary to hold in abeyance our judgment as to the source of origin of the carbonaceous matter which has become metamorphosed into graphite in the rocks of this early period.

The second series of Pre-Cambrian rocks was deposited upon the former after the period of denudation mentioned above. This period of denudation indicates a time-interval which has not yet been accounted for by the discovery of sediments which must have occurred during its progress. There is thus a break in the continuity of these two periods; when the deposits of this early epoch are better known, and the sediments which were occurring while the above denudation was in progress have been found, this break will disappear, as has been the case in the history of other geological epochs. The history of this branch of research contains many instances of such breaks or gaps in the sequence of the rocks. Such gaps are due to limitations of our knowledge regarding vast areas of the earth's surface which have not yet been completely investigated. As time and discovery have progressed the gaps have become fewer. We may therefore look forward to a time when the "break" in the Pre-Cambrian period will be filled as completely as the break which was once supposed to exist between Cretaceous and Eocene times.

The sediments composing the second series have been raised in places some thousands of feet above the level of deposition, but beyond some tilting they have not undergone much physical change. The Torridon sandstone of Scotland represents this series in Britain. It contains conglomerates, the pebbles of which have sometimes come from a source not yet discovered, for they consist of material not found in the first series. There are no fossil remains in this sandstone, so far as research has yet been able to show.

In the United States fossils have been discovered beneath the lowest fossil zone of the Cambrian period of the Colorado Cañon. These consist of marine forms similar to some of those of the Cambrian, resembling trilobites, corals and molluscs.

In Brittany a certain graphite which has been classed as Pre-Cambrian has yielded radiolarians; but the diagnosis of the age has been questioned.

A structure variously ascribed to fucoids and to the trails of

jelly-fish, and also a mollusc, have been discovered beneath the Olenellus zone in Norway.

In France, Bavaria, Spain, Scandinavia, Russia, India, and China, the pre-Cambrian rocks present similar structure to the above. In South Africa and New Zealand similar rocks are found, but the strata in contact with them present life-forms of later date than Cambrian. In New South Wales Cambrian species overlie the earliest rocks. In Canada they are extensively visible, also in Greenland. On the Atlantic border of the United States, and in the Rocky Mountains and localities on the Pacific border, they are also present.

So far as actual fossils are concerned, in these early rocks we are in possession of certain marine forms which have attained considerable differentiation. As stated above, they have been found in the Colorado Cañon. They have also been found near Lake Superior and in Norway. Similar rocks in other localities have not yielded any fossils. Our earliest fossils, then, are removed by a considerable differentiation from the lowest possible type. Their limitation as to locality, numbers and species indicates merely that time was required for the display of the profusion of similar forms found in the next geological period; though even this fact must be discounted by another, viz., that we have not yet explored more than a small portion of the earth. Still, the fact of their presence at the localities mentioned above, and absence from numerous other spots at which fossils of and above the Olenellus zone occur, suggests that time had not yet been afforded for their spread into the marine sediments of corresponding age occurring in other parts of the world.

When undoubted freshwater sediments of this period are forthcoming we may expect to find at least equally unequivocal traces of flora and perhaps of land fauna; the flora at least must be held to have been existent, in view of the probable origin of the graphite beds referred to above. But, as things are, we have to acknowledge that we can only presume that the lowest forms of life existed in pre-Cambrian times, because we find certain rocks composed of materials which in the present day are being produced by animal and vegetable life; and also because we have some specimens of a marine fauna presenting an advanced evolutionary condition, and therefore earlier forms must have preceded them, if they sprang originally from not-living matter.

The next period, the Cambrian, succeeded the one just summarised in some places without a break in the continuity of sedimentation; in other parts the subjacent pre-Cambrian has

been displaced and denuded, while the Cambrian strata themselves have since undergone considerable changes from physical causes. In America limestones are frequent on the western side in this period, in other localities sandstones, &c.

The commencement of the Cambrian is marked geologically by an arbitrary line, but that line, which has already been referred to, is invaluable for purposes of definition. The line is a series of sediments called, from the presence of characteristic trilobites, the Olenellus zone. From this zone upwards we are in presence of a profuse and increasing marine fauna living in a sea which was becoming more shallow and muddy.

The fossils found in the Cambrian period represent numerous genera of molluces, corals, crustaceans, stone-lilies, &c. The class crustacea includes the trilobites, from which the modern crustaceans may have been descended.

The presence of sea-weeds has been conjectured from certain markings on sandstones. But no actual vegetable forms are yet forthcoming. Algæ are possibly represented by a fossil found in Ireland, the nature of which has been the subject of some discussion.

Cambrian fossils have been found in Britain, Portugal, Spain, Sardinia, France, Norway and Sweden, Bohemia, Russia, and India (Salt range). They are also present in China, the east, north, and west of the United States, and Canada, including Newfoundland, Nova Scotia, and New Brunswick; in Northern Argentina (Upper Cambrian), and in Australia and Tasmania.

The Cambrian strata proceed in many places without physical break into the next series, the Silurian, which are composed in North America and Scotland largely of limestones; they are therefore deep-water deposits. In the remainder of Great Britain and elsewhere shales and mudstones are the most frequent deposits.

The base of the Silurian is marked by fossils called *Graptolites*, of the genus *Tetragraptus*.

The formations of this period have furnished many new types of marine life, including Eurypterids and Foraminifera. Of the latter the genus *Saccamina*, which occurs in the lower Silurian of Ayrshire, is still in existence. Eurypterids, gigantic crustaceans attaining sometimes to six feet in length, appeared in the Upper Silurian of New York and Britain. Originally marine forms, they migrated to shallow water in the Carboniferous period.

In Britain the first trace of fishes appears in the lower part of the Upper Silurian near Ludlow, while a little later—that is, a little higher in the series of beds—large numbers of fish-remains are found,

belonging to the same sub-class of armour-plated fishes. The tail had one fin longer than the other. One order possessed a pair of paddles. Fish-spines in these strata in the east of North America and in Europe may represent another sub-class of fishes with partially calcified endo-skeleton. These were covered with scales of the same structure as the teeth. Sharks and rays belong to this group, which is to-day represented in the seas of Japan and Australia.

In the Lower Silurian of Colorado, some plates and scales discovered are supposed to represent ganoids, or gars—fish with enamelled scales, whose vertebrae present different amounts of ossification. Elsewhere ganoids have not been found previous to the Old Red Sandstone.

Fish-remains have been found in the Upper Silurian of Russia, Scandinavia, Gothland, Galicia, Germany, New Brunswick, and in the Niagara shales (Upper Silurian) of North America (Pennsylvania).

Traces of sea-weeds have been found in the Lower Silurian of Britain. They became pronounced in the Upper Silurian (Ludlow), in the upper parts of which strata plants have been found which suggest club-mosses. In addition to sea-weeds, the Upper Silurian of Michigan has furnished horse-tails, or Equiseta.

In this period we obtain land-forms for the first time. The Upper Silurian of Scotland (Pentland Hills), Gothland and the United States (Water-Lime of New York) has shown air-breathing scorpions, one specimen having been obtained from each of those places.

The upper part of the Lower Silurian in Southern Sweden has furnished the wing of an insect belonging to the Hemiptera. The wing of an orthopterous insect has been found in the Middle Silurian of Jurques, Calvados (France). It was formerly regarded as belonging to a cockroach.

The discovery of these arachnids and insects near the margin of the modern Atlantic suggests a practical continuity of the land which furnished the sediments in which they were buried. Such land probably stretched across from near the East of Canada, a large part of which was then above water, to somewhere near Norway and the West of Britain. The discovery of similar land-forms in strata of Lower Silurian age at some locality not on or near the Atlantic margin would obviously be at variance with such an idea; hitherto no such discovery has been made, while the history of the next period, the Devonian, shows more marked evidence of the presence of terrestrial conditions, and of new terrestrial life-forms in the same region, *i.e.*, in deposits contained in countries which now form the border of the North Atlantic.

The period in which the rocks called Devonian were laid down was coeval with that called the Old Red Sandstone. This fact is best exemplified in Russia, where a vast area is covered with rocks which pass in places from the limestones and shales containing fossils of the types found in Devonshire and Cornwall, laterally into the red sandstones and shales containing fossils similar to those of the Old Red Sandstone found in Scotland, Shropshire and South Wales. Both varieties continue in unbroken succession from the underlying Silurian rocks. The Devonian limestones contain an extensive fauna and flora. Ammonoids first appear; sea-weeds were frequent. The Devonian strata are found in Britain, whence they probably continue under the later rocks into Belgium and the North of France. They occur in Germany, Austria and Russia. In America they occur in the United States, Canada, New Brunswick and Nova Scotia. Devonian rocks are found also in South-west China, New South Wales, Victoria and New Zealand, Bolivia, Brazil and the Falkland Islands. In South Africa the Bokkeveldt Beds, and also the Pretoria Series, are referred to this period.

The shallow-water sandstones (Old Red) and shales are the repositories of a large collection of fish-remains containing forms we have already seen, but with a large increase in ganoids, both in variety and size. These occur in Britain, Baltic Provinces, Germany, and in the Devonian of North America. Traces are found in Bohemia and Belgium. Lung-fishes (*Dipnoi*) are represented by dental plates found in rocks of the middle Devonian on the east of the United States, and by complete forms in the Old Red Sandstone of Scotland. Other genera occur in the Upper Old Red Sandstone of Scotland, and in the Upper Devonian of Belgium and Pennsylvania. Lung-fishes are represented in the present day by the "Barramunda" of Queensland, the *Protopterus* of Africa, and the *Lepidosiren* of South America. The genus *Ceratodus*, to which the Barramunda belongs, is not found fossil before the Triassic period. The fact of their air-bladder being adapted to serve as a lung has led to the inference that lung-fishes may have been the ancestors of amphibians. This is supported by the embryonic form of the vertebral column, the labyrinthine teeth, and other points.

The flora, besides marine and lacustrine types, consists of a land vegetation which Sir William Dawson describes as containing "about a hundred species, representing more than thirty genera, and including all the great types of vascular cryptogams, the gymnosperms, and even one (still doubtful) angiosperm."[1] This

[1] "Geological History of Plants," p. 46.

suddenly developed accession of plants is represented in the Erian (= Devonian) of North America, and is far in excess of the "comparatively depauperated representatives of this portion of the geological scale in the Devonian of Western Europe."[1] Ferns, tree-ferns and yews abound. We are carried to the Antipodes for a modern example of the forests of the Devonian period, where the indigenous flora of New Zealand has not advanced much beyond these types. A further evidence of the vast collection of plants existing in the Devonian is the presence within the shales of this period of "countless millions of tons" of the macrospores and sporocarps of plants.

Club-mosses grew to the size of trees. Ferns attained the size of tree-ferns. Horse-tails were present. Gymnosperms were represented by yews and cycads. The yews resembled the Norfolk Island pine as regards the wood; they may therefore have been conifers. They were present in Norway and Spitzbergen, Scotland and Germany, as well as in North America, in the Gaspé Sandstones, in New Brunswick, New York, Maine, Pennsylvania and Ohio. This burst of land flora upon the scene is remarkable not only for the variety but for the multiplicity of individuals; for in Spitzbergen the vegetation was sufficiently plentiful to furnish material for seams of coal. The plants appear, too, as advanced types of the orders to which they belong, including certainly all classes except angiosperms.

With regard to the "doubtful" angiosperm, Sir William Dawson thinks the sole specimen found may have got by some accident among Devonian fossils, as the plant has not been found elsewhere in any formation earlier than Middle Cretaceous.

But these plants were not the only evidence of terrestrial life, for numerous insects have been found in the Devonian of St. John's, New Brunswick. Gigantic Ephemera (May-flies), together with other insects, including neuroptera, besides several forms of myriapods have come to light from this locality. These beds have also produced a pulmonic snail.

Two genera of Myriapods have been reported from the Old Red Sandstone of Forfarshire. In the next period these arthropods become numerous.

Prints of feet (with five digits) in the Upper Devonian of Pennyslvania, and some obscure remains from the Belgian Devonian, give us the first trace of quadrupeds and bipeds whose actual forms we shall shortly unearth.

Generally the Carboniferous strata are continued up from the

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[1] *Ibid.*, p. 108.

last group without any break. One of the exceptions is the east of Canada and Nova Scotia, where the Carboniferous lie unconformably on the Devonian rocks. The latter have become raised to form a land-surface, whence the terrestrial life-forms spread and became preserved in the deposits laid down in Carboniferous times.

Although not a novelty as regards the order to which it belongs, the widespread appearance of the foraminifera *Fusulina* must be noted as a characteristic of the limestones of this period.

The flora of the Devonian period reappear in the Carboniferous, but in the shape of new genera and species of club-mosses, ferns, cycads and horse-tails. One form of the club-mosses of this time presents so many species that Sir William Dawson considers that in these plants "we have a group divisible into several forms, some of which will eventually be classed with the lepidodendra as lycopods, while others will be found to be naked-seeded phænogams, allied to the pines and cycads, and to a remarkable group of trees known as Cordaites."[1] If this be so the Sigillariæ may perhaps occupy a position in the plant world analogous to that of some of the generalised types found later among mammals. The conifers of this period are of the type noted before under the Devonian as resembling the Norfolk Island pine.

In Nova Scotia land-shells have been found in the trunks of trees of this period.

Footprints of Amphibia are frequent on the mud of the Carboniferous period, as preserved in Nova Scotia, Pennsylvania and Kansas. They are found also in other countries, but not until a later period.

The most marked novelty in the carboniferous life-forms is the appearance of amphibians. These are found in the coal-measures of Britain and Ireland, Bohemia, Nova Scotia and Ohio. The Amphibia sometimes have gills. The limbs (occasionally absent) are adapted for swimming or walking; the hand has four or five, the foot five, digits.

In Nova Scotia some biconcave vertebræ have been found which were formerly considered to belong to a reptile, but which probably belong to the same family as an Amphibian from the Carboniferous of Northumberland.

The sudden arrival upon the scene of an animal possessing new organs, hands and feet points out to us the absence of a stage intermediate between the fin and the limbs of vertebrates; for

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[1] "Geological History of Plants," p. 116.

there is nothing among the preceding fish approaching limbs more closely than the paddle mentioned above as pertaining to some of the earlier fishes. The lung-fishes, perhaps, are the nearest approach to the Amphibia, but there is a wide gap between the lung-fish adapted for burying itself in the mud of tropical rivers during the periods between floods, and the five-toed, four-limbed amphibian walking across the same mud-flats, whose ripple-marks are still preserved with the footsteps of these first-known quadrupeds.

Strata in other localities than those already named contain rocks classed as Carboniferous. This classification is supported by the presence of marine fossils; the countries containing such strata are therefore homotaxial with the strata containing the amphibian forms just noticed. But the amphibian forms are as yet absent. Such countries are Russia, Africa, Asia, Australasia, and South America, and the west of North America.

The next geological division is the Permian period. The rocks of this period continued without disturbance from the preceding Carboniferous, but many changes occurred in the life-forms. Thus, as regards plants, many of the former genera died out, while ferns and tree-ferns and horse-tails increased in numbers and in genera, while new genera of cycads and pines (Araucaria) appeared. The Amphibia present new genera in Texas, New Mexico, Illinois, in England and in Europe; in the latter continent they appeared in Prussia, Saxony, Russia, France.

From our present point of view, the most interesting facts are those which illustrate the appearance of new orders, and here in the Permian we find reptiles under early forms represented in the present day by the lizard *Hatteria*, which exists in New Zealand only. The Permian reptiles bear much resemblance to the Amphibians; they are credited with being the ancestors of all reptiles and birds. The earliest known forms are the "Earlier" Reptiles from the Lower Permian of Germany and France (Autun). Later, other genera appeared in Bohemia, France, Texas, Illinois, and Kansas, and in the Upper Permian of Durham and Thuringia.

(*To be continued.*)

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AMBULANCE TRANSPORT IN MANCHURIA.

The figure below is an illustration of a light hand ambulance cart in use by the Russians in Manchuria. The cart is made of half-inch wood. The whole is put together with bolts and nuts, and it is very light and can be pulled by one man. The bottom of the cart is made of canvas, under which are stretched broad tapes, one

Transport of Wounded after the Battle of Liao-yang.

tape down the centre and three from side to side. There is one rest at each end of the cart to keep it level while loading. There is an iron bar under the cart, which goes across from side to side above the axle. In front of the cart is a canvas flap or continuation of the bottom of the cart. The back is closed by a wooden board. Diameter of wheel, 54 inches. Width of wheel track, 44 inches.

Translation.

EXTRACTS FROM INSTRUCTIONS FOR THE RUSSIAN ARMY RESPECTING THE LAWS AND CUSTOMS OF WAR ON LAND.[1]

I.—Instructions for Officers.

(1) *On the Qualifications of Belligerents.*

1. In time of war the enemy's armies, militia, and volunteer corps are regarded as belligerents.

2. Volunteer corps and militia, however, are recognised as belligerents only when commanded by an officer who is responsible for his subordinates, when they have a visible and clearly recognisable distinctive emblem, carry arms openly, and conduct their operations in accordance with the laws and customs of war.

3. The inhabitants of a hostile country may[2] also be regarded as belligerents, if they have taken up arms on the approach of our troops without having had time to organise themselves into corps of volunteers, provided that they respect the laws and customs of war.

(2) *On the Qualifications of Neutrals.*

4. Military ambulances and hospitals[3] are recognised to be neutral (non-belligerent and taking no part in hostilities) only so long as sick and wounded may be therein. Their neutrality ceases if they are defended by a military force.

5. The transport used for the conveyance of wounded, and all persons necessarily accompanying it, enjoy the rights of neutrality.

6. The benefit of neutrality is accorded to the following while engaged in their duties: all persons comprising the staff of hospitals and ambulances, doctors, officials, attendants, those employed in the transport of wounded, and military chaplains.

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[1] These instructions are issued apparently in order to carry out Article 1 of the Hague "Convention with Respect to the Laws and Customs of War on Land," which reads: "The High Contracting Powers shall issue instructions to their armed land forces which shall be in conformity with the 'Regulations Respecting the Laws and Customs of War on Land,' annexed to the present Convention." (Translator.)

[2] The Hague Regulations say "shall" ("sera" in the French text). (Translator.)

[3] The Russian text uses the words "lazareti" and "gospitali" where the English and French versions of the Geneva Convention have "ambulances" and "hospitals." "Lazaret," however, includes the two organisations known in the British Army as "bearer companies" and "field hospitals." Where the Convention draws a distinction, as regards liability to capture of equipment, between ambulances and hospitals, the Russian text makes use of the expressions "field lazareti" and "travelling lazareti." (Translator.)

7. The persons designated in Paragraph 6 may continue to fulfil their duties in the hospitals and ambulances during our occupation of hostile territory, or may withdraw to their own army. The arrangements for the return of such persons will be made by the corps commander concerned; they are to be delivered to the outposts of the enemy. As the equipment of hospitals remain at the disposal of troops in occupation, persons attached to these establishments cannot, in withdrawing, carry away any articles but such as are their private property. The seizure of the equipment of an ambulance belonging to the enemy is forbidden.

8. Military hospitals, ambulances, and transport for wounded must be indicated by means of the Red Cross flag. Each member of the medical and hospital staff of these organisations must have a white arm-badge with a red cross.

(3) *On the Rights and Duties of Belligerents.*

9. Troops must respect the lives and honour of the inhabitants of the enemy's country, their families, and rights of property, as well as their religious convictions and ceremonies.

10. Possession may be taken of all movable property of a belligerent State, which may be used for military purposes, such as cash, funds, depôts of arms and provisions, materials for bandaging, &c. Likewise troops may take possession of railway plant, telegraphs, telephones, steamers, and other ships, as well as depôts of warlike and other stores,[1] even though belonging to companies or private individuals.

11. It is prohibited in military operations—

(*a*) To employ poison or poisoned arms with the object of causing hurt to the enemy, and weapons, projectiles, and material of a nature to cause superfluous injury.

(*b*) To declare that no quarter will be given.

(*c*) To make improper use of a flag of truce, the national flag, the military distinguishing marks, or the uniform of the enemy.

(*d*) To employ the Red Cross flag or arm-badge for the purpose of deceiving the enemy.

(*e*) To destroy or seize the enemy's property, except (i.) under circumstances laid down in Paragraph 10, or (ii.) when military exigencies render it imperative.

(*f*) To attack or bombard a town, village, habitation, or building not occupied by the enemy, nor by depôts of material necessary for the prosecution[2] of the war.

(*g*) To pillage a town or place even when taken by assault.

12. All pillage is forbidden under the penalty of death.

[1] The words "and other" are not in the Hague Regulations. (Translator.)

[2] The words "depôts of material necessary for the prosecution of the war" are not in the Hague Regulations. (Translator.)

13. The seizure, destruction, or intentional damage of the property of religious, charitable, and educational institutions, and of those of arts and science, and of historical monuments, is prohibited.

14. The commander of an attacking force must take care to warn the inhabitants of the intended bombardment of a town or place, unless military exigencies (for instance, the necessity of surprise) render it impossible for him to do so.

15. In sieges and bombardments all possible means must be taken to spare churches, museums, educational and charitable institutions, hospitals, places where the wounded are collected, &c., always provided that these places are not used at the same time for military purposes. All such buildings should be indicated by particular signs, which should previously be notified to the assailants.

16. Any compulsion of the population of occupied territory to take part in military operations against their own country, or any pressure on them to take the oath of allegiance to the hostile power, is prohibited.

17. Contributions (money taxes) can be collected only by the written order of the Commander-in-Chief of the Army. For every payment a receipt must be given.

18. Requisitions (compulsory supplies) in kind, or in service, can be demanded from the inhabitants only by the authority of the Commander-in-Chief of the Army, or of the commander of a military district (commanding the troops in the district), or, in cases not admitting of delay, by the authority of a corps or divisional commander.

19. Requisitions of service must not be of such a nature as to involve the population in the obligation of taking part in military operations against their own country.

20. Requisitions and services should, as far as possible, be paid for in ready money; failing this, a receipt should be given (with the signature and seal of the commander of the detachment).

(4) *On the Wounded.*

21. Wounded and sick soldiers shall be entertained and taken care of, to whatever army they may belong.

22. The exchange of wounded may be carried out by the commander of an army, but only with the consent of both belligerents. The enemy's sick and wounded left in our hands shall be sent back to their own country if recognised, after recovery, as incapable of serving; the others may be sent back on condition of not again bearing arms during the continuance of the war.

23. Commanders of armies will notify to the inhabitants of the country that they must afford all possible aid to the wounded of both sides; those who have entertained and taken care of wounded shall be exempted from the quartering of troops, as well as from a part of the contributions of war which may be imposed.

24. After a battle, commanding officers and higher authorities will take measures to protect from robbery both those of our own and the enemy's wounded who may still be on the field of battle. Persons found guilty of robbing the wounded with violence will be dealt with as guilty of brigandage.

(5) *On Prisoners of War.*

25. Both combatants and non-combatants are liable to capture; both have the right to be treated as prisoners of war.

26. Newspaper correspondents, sutlers, contractors, &c., who fall into the enemy's hands, and whom the latter think fit to detain, have the right to be treated as prisoners of war, provided they can produce a certificate from the military authorities of the army they were accompanying.

27. The reception, maintenance, and safe custody of prisoners, and their further disposal, are the duties of the corps commanders, and are carried out under the direction of the chief of the staff of their corps.

28. Prisoners must be humanely treated and afforded every facility for the exercise of their religion. They shall be treated as regards food and maintenance on the same footing, rank for rank, as the troops of the Russian Army.

29. Every prisoner is bound to declare his true name and rank, and if he disregards this rule he is liable to a curtailment of the advantages granted to the prisoners of his class.

30. Prisoners of war are subject to the laws, regulations, and orders in force of the army into whose hands they have fallen, and, in the event of any act of insubordination, to such measures of severity as may be necessary.

31. An officer in command of an armed party detailed as escort to prisoners, is in the position of an officer commanding a post, and will act in accordance with the Regulations for Duties in Garrison (Articles 198-210).

32. The personal belongings of prisoners of war, except arms, horses, and military papers, remain their property.

33. Prisoners who, after a successful escape, are again taken prisoners, are not liable to any punishment, but will be subjected to a stricter surveillance.[1]

34. Escaped prisoners, recaptured before they have succeeded in rejoining their army, are liable only to disciplinary punishment.

35. The wills of prisoners of war will be drawn up and received for record on the same conditions as those of soldiers in our service.

36. Should a prisoner of war die, a death certificate will be made out, and at the burial due regard must be paid to the grade and rank of the deceased.

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[1] The words " but will be subjected to a stricter surveillance " are not to be found in the Hague Regulations. (Translator.)

(6) *On Flags of Truce.*

37. The bearer of a flag of truce (*parlementaire*) is an individual who is authorised by one of the belligerents to enter into communication with the other, and who comes with a white flag. The bearer of a flag of truce has the right to inviolability, as have also (*a*) the trumpeter (bugler, drummer), (*b*) the flag bearer, and (*c*) the interpreter, who accompany him.

38. The commander to whom a bearer of a flag of truce is sent is not obliged to receive him under all circumstances.

39. He will take all measures necessary to prevent the bearer of a flag of truce from taking advantage of his mission to obtain information. In case of abuse he has the right to detain the envoy temporarily.

40. The bearer of a flag of truce loses his rights to inviolability if it is proved that he has taken advantage of his privileged position to instigate treachery.

41. The raising of a white flag by the enemy during an action does not suspend the course of the fight, but the person holding the flag, the *parlementaire*, and those who accompany him, are not to be fired on. When the *parlementaire* approaches our lines, he is to be directed to the commander to whom he has been sent, or to the senior officer. The fighting ceases only when the enemy's troops lay down their arms and fulfil the conditions prescribed.[1]

(7) *On Spies.*

42. Spies are persons who, acting clandestinely or on false pretences, seek to obtain, in the zone of operations of our forces, any kind of information with the intention of communicating it to the enemy.

43. Spies cannot be punished without previous trial.

44. The following are not considered spies :—

(1) Soldiers (not in disguise) who have penetrated into the zone of operations of a hostile army to obtain information.

(2) Soldiers and civilians carrying out their mission openly, charged with the delivery of despatches intended for their own army or for that of the enemy.

(3) Individuals sent in balloons to maintain communication between the various parts of an army or of a territory.

II.—Instructions for the Rank and File.

1. Thou fightest with the enemy's forces and not with the peaceable inhabitants. The inhabitants of a hostile country may also be enemies, but only when they are seen by thee with weapons in their hands.

[1] In the war of 1877-78, during General Gourko's movement towards the Shipka, our riflemen, seeing the white flag of truce of the Turks, stopped firing and began to parley; the Turks, however, after some time, opened fire again without any warning. ("Military Historical Records," Section II., part No. 4804, page 93.)

2. Kill the enemy in fair fight; do not kill unarmed men who ask for quarter.

3. Respect the religion of others and their places of worship.

4. Do not insult peaceful inhabitants of an enemy's country, do not damage or steal their property, and prevent thy comrades from so doing. Harshness towards the inhabitants only increases the number of our enemies. Remember that a soldier fights for Christ and the Tsar, and should, therefore, bear himself as a Christian warrior.

5. When a fight is over succour the wounded, and endeavour to the utmost of thy power to help them irrespective of nationality. The wounded are in no sense to be regarded as thy enemies.

6. Prisoners must be humanely treated, their religion must be respected, they must be protected from oppression and robbery.

7. For a soldier to rob prisoners is most disgraceful, and to rob the killed and wounded is even more so. Those guilty of such offences are liable to the same severe penalties as are decreed for highway robbery.

8. If thou shouldst be placed in charge of prisoners, protect them from annoyance by strangers. Should a prisoner try to escape, prevent him, and call for aid; as a last resource use thy weapons.

9. Tents and houses where sick and wounded lie have always a white flag with a red cross; do not fire at or break into these places.

10. Do not harm persons, even though in the uniform of the enemy, who wear a white badge with a red cross on their arm; they tend the sick and wounded, and restore them to health.

11. If thou seest an enemy with a white flag, do not fire on him, but direct him to an officer; he is the bearer of a flag of truce, a person who must not be harmed.

Abstract.

THE JAPANESE HOSPITAL SHIPS.

By Lieutenant-Colonel J. E. NICHOLSON.
Royal Army Medical Corps (*Retired*).

(From an article by Surgeon-Major Varenne, in the *Archives de Médecine Navale* for October, 1904).

The Japanese practise during their actual military operations a system of evacuation of the sick and wounded which, by its organisation and state of perfection, is worthy of attracting the attention of those who appreciate all the importance of such a service in modern wars.

The degree of perfection to which the Japanese hospital ships have reached is due not only to the marvellous faculty of assimilation peculiar to the Japanese nation, but also to its combination with an originality and an initiative which many of the large European nations might well envy.

The evacuation of the sick and wounded towards the Japanese hospitals is carried out by two services: (1) The Medical Service of the Japanese Navy; (2) the Japanese Red Cross Society.

(1) *The State Hospital Ships.*—The State has specially fitted up two hospital ships, the "Kobe-Maru" and the "Saiko-Maru." These two sister ships are of British construction, with a displacement of 3,000 tons, and a speed of 15 knots. They fly the Japanese commercial ensign, and the flag with the Geneva Cross at the main mast. Although specially fitted up for war they retain their mercantile complement of officers and men. Their medical staff consists of a surgeon-in-chief, 5 surgeons, 2 assistant surgeons, 2 compounders, 30 sick attendants, but no female nurses.

Arrangements.—The sick officers are accommodated in roomy cabins, which are usually fitted with two berths. The ordinary sick are placed in berths of metallic construction, superposed in two ranks in large wards, which are perfectly ventilated. The walls are covered with so-called "Japanese paint," which can stand being scrubbed with boiling water. There is also an isolation ward and a lunatic ward. All these compartments are in the after-half of the ship.

Forward are the accommodation for the sick attendants, a steam laundry, a large disinfection stove, and a cold chamber for the preservation of corpses. Amidships are the operating theatres and the surgery, both of which are sufficiently lighted by large port-holes. The walls are covered with white lacquer. The surgical equipment represents the

latest thing in modern perfection of its kind. The whole of this service is organised to perfection, and a scrupulous degree of cleanliness exists throughout the ship. Adjoining the operating room is a very comfortable laboratory for radioscopy and radiography, which has been in constant use since the commencement of the war and of the utmost service.

On the upper part of the deck is the laboratory of pathology and of bacteriology, admirably equipped and well lighted; the microscopes are all of French or German manufacture. On this deck are also the medical officers' quarters, the medical inspection room, kitchens, &c., &c.

A ship of this type can accommodate 30 sick officers, 200 sick or wounded, and 80 contagious cases.

(2) *The Japanese Red Cross Society.*—This Society is one of the most complete of its kind, with a membership of close on a million, and a budget of 8,000,000 yen. It consists of 110 companies, each consisting of 4 surgeons and 40 sick attendants (male and female); the total *personnel* at present employed either on the hospital ships or in the ambulances being 3,099. It has equipped and actually maintains two hospital ships, the "Hakuai-Maru" and the "Kosai-Maru," for the evacuation of the sick and wounded, and they are fitted up as regards their interior arrangements on practically the same lines as the "Kobe-Maru" and the "Saiko-Maru."

The Red Cross *personnel* on one of these ships consists of 1 physician-in-chief, 2 physicians, 2 surgeons, 40 trained sick attendants (male and female) and one functionary (appointed by the Minister for Foreign Affairs) to carry out the administrative work and the up-keep of the ship.

These vessels have always kept pace along the coast with the onward march of the Japanese armies.

Reviews.

"Reports of the Trypanosomiasis Expedition to the Congo, 1903-1904, of the Liverpool School of Tropical Medicine and Medical Parasitology," by J. Everett Dutton, M.B.Vict., John L. Todd, M.D.McGill, and Cuthbery Christy, M.B.Edin.; with "A Comparison of the Trypanosomes of Uganda and the Congo Free State," by H. Wolferstan Thomas, M.D. McGill, and Stanley F. Linton, B.Sc., M.B., Liverpool; and a "Note on Tsetse-Flies," by E. E. Austen, Zoological Department, British Museum. Published for the University Press of Liverpool by Williams and Norgate, 14, Henrietta Street, Covent Garden, London. August, 1904.

In the preface to these Reports it is stated that, "In 1901, trypanosomes were discovered in the blood of a European by J. E. Dutton, Walter Myers Fellow, while on an expedition of the Liverpool School of Tropical Medicine to Gambia. In consequence of this observation an expedition composed of Drs. Dutton and Todd was sent in 1902 by the School to Senegambia to prosecute further researches in trypanosomiasis. The detailed report of the expedition was published in 1903, and contained a study of the pathogenic trypanosomata of man and animals, several new species being described.

"Prior to the return of this expedition, the discovery of trypanosomes in the cerebro-spinal fluid of cases of sleeping sickness in Uganda by members of the Sleeping Sickness Committee of the Royal Society caused the subject of trypanosomiasis to assume greater importance. At the same time it was brought to the notice of the Committee of the Liverpool School that in the Congo Free State the native population had from time to time suffered from very fatal epidemics of this disease. The Committee therefore decided to accept the invitation of His Majesty King Leopold to send an expedition to study sleeping sickness in that country. Drs. Dutton and Todd were recalled from the Senegambia, and as soon as they had drawn up their reports they left for the Congo, in September, 1903, and were soon after joined by Dr. Christy, who had served previously on the Royal Society's Sleeping Sickness Commission in Uganda. On reaching the Congo the expedition decided to make Leopoldville its headquarters. The authorities of the Free State at the same time attached Dr. Inge Heiberg, an old pupil of the School, to the expedition, and to him the members are greatly indebted for his aid in the work. A special hospital was erected by the State, in order that the observers might have the sleeping sickness cases under their care, and facilities were given for the study of a large number of patients. The results of these investigations are incorporated in the present volume, and illustrate the occurrence and distribution, describe the symptoms of trypanosomiasis in all its stages, both in Europeans and natives, and show how sleeping sickness, so-called, is related to trypanosomiasis as a symptom of that disease.

"At the same time the Committee resolved to continue the researches in Liverpool, which had been started by Drs. Dutton and Todd in Sene-

gambia. Dr. Thomas was appointed to conduct the work, and, aided by Dr. Lynton, experiments were immediately commenced, a preliminary note of their work being embodied in this Report. The two groups of observers have throughout worked together, and in order that comparable data might be obtained, selected cases of sleeping sickness were, by permission of the Congo Free State authorities, sent to the observers in Liverpool. A later report will be published on these cases. As far as the very numerous and detailed observations of these workers go, they show that the parasite identified with sleeping sickness in Uganda and the Congo does not differ from that described by Dutton in the Gambia. This view is also held by Laveran and Mesnil in France, and Bruce in this country. The question of a curative agent has for a considerable time engaged the attention of the members of the research, and experiments are now in progress to find a remedial agent which would have the same effect in trypanosomiasis that quinine has in malaria. A variety of drugs have been used with more or less success; up-to-date, arsenic and trypan-red, an aniline dye introduced by Ehrlich and Shiga, appear to be the most useful. The parasite disappears for a time from the blood, and the life of the animal is prolonged, but with neither of the drugs is an absolute cure attained. A combination of the two appears to offer better results. A large number of animals infected with different trypanosomes are under treatment. The present report also embodies an important Note on the Tsetse-flies by Mr. E. E. Austen, to whom the School is much indebted for describing and identifying the diptera obtained during the expedition.

"Much important work remains to be done; a further study of the disease from a clinical aspect, extended experiments on the transmission of trypanosome diseases by biting flies, and researches on the lines of Schaudinn's work, together with therapeutical observations in patients and large animals naturally infected with trypanosomes, are urgently needed."

There are seven papers in all in this report. The first is entitled, "Human Trypanosomiasis on the Congo (First Progress Report)." The second, "Human Trypanosomiasis and its Relation to Congo Sleeping Sickness." The third, "The Congo Floor Maggot." The fourth, "The Cerebro-Spinal Fluid in Sleeping Sickness." The fifth, "A Comparison of the Animal Reactions of the Trypanosomes of Uganda and Congo Free State Sleeping Sickness, with those of *Trypanosoma Gambiense* (Dutton)." The sixth, "Two Cases of Trypanosomiasis in Europeans"; and the seventh, "Supplemental Notes on the Tsetse-Flies."

D. Bruce.

"The Royal Army Medical Corps (Vols.), Glasgow Companies, Annual." December, 1904. Price 3d.

We have great pleasure in welcoming the fourth issue of the Glasgow Medical Corps Annual, not only on account of its high literary standard, but also because its pages afford abundant evidence of the thoroughness of the work which is being done by the Glasgow Companies, as well as of the keenness and energy displayed by both officers and men, in availing themselves of every opportunity afforded them for gaining practical experience in field work. Like its predecessors, this issue of the Annual

contains many instructive and interesting articles, and the illustrations, which are a prominent feature, are exceptionally well done. Lieutenant-Colonel Beatson's paper on the "Mobilisation and Management of a Field Hospital" is particularly good. He puts before the reader in a most instructive way the steps to be taken on mobilising, and in drawing equipment, he gives many useful details regarding the hospital itself, and he ends with a carefully thought out description of the duties and responsibilities attaching to the different ranks of the hospital *personnel.* Other contributions include "Our Camp at Netley," by Major J. McGregor-Robertson, M.B.; "The Amalgamation of the Scottish Companies," by Captain F. Kelly; "Our Transport" (the Camp at Portsmouth), by Lieutenant and Quartermaster H. Miller, M.A. These papers deal with experiences in camp, and it is satisfactory to note that in both instances the trainings were considered decided successes, not only as regards work but also as regards play. Major Moffat's paper on "The H.L.I. Brigade Bearer Company at Stobs" also testifies to the success of the training there. From the holiday side, interesting papers are "The Isle of Wight," and "A Drive through London," by the Editor, Captain Halliday; "Cycling in the New Forest" by Captain Young; and "A Visit to the London R.A.M.C. (Vol.)," by Private Walter Smith. Captain J. D. Graham, I.M.S., contributes an interesting paper on "A Himalayan Holiday." In lighter vein, we have "Ta Piper McSneezly," by Dr. William Burns, and "The Widow Rintoul Reflective," by Captain H. Wright-Thomson, M.D. (both of which have been excellently illustrated by Surgeon-Captain Wilson-Gunn). Both editor and sub-editor are to be congratulated on the success of the magazine, and on the excellent use they have made of the wealth of material which they have been fortunate enough to have at their disposal.

T. McCulloch.

Current Literature.

Discipline Companies in the French Army.—In *Le Caducée* for January 7th, 1905, Dr. Uzac, of the Chasseurs d'Afrique, gives some details regarding the companies thus designated. They are composed of men sent to them by order of disciplinary commissions, after trial for offences of a less serious character than those dealt with by courts martial. One such company contained 431 men. Their offences could be classified as follows: Habitual indiscipline, with repetition of the same faults, 113; repeated drunkenness, 121; absence without leave, often combined with the offences just mentioned, 191; acts of immorality, 19; simulation, 15; mutilation, 23. The two last-named offences are those which especially interest the army surgeon. One group comprised 3 cases of pretended lameness, 1 of imbecility, and 1 of pains in the legs. In a second group there was exaggeration of the effects of such conditions as slight varix, old sprains and fractures, and superficial cicatrices non-adherent to deeper parts.

Mutilation was most often practised on the fingers. In 5 cases the left thumb had been removed; in 7 the index finger (5 times the right and twice the left). In one case both forefingers had been removed, and in 2 the left middle finger. In one case there was a gunshot wound of the palm of the left hand. In three cases the injury was of a curious kind—the second toe of the left foot had been fixed in such a position as to create the "hammer-toe" deformity. The men were peasants, belonging to the same district; they had been assisted by a farrier. A piece of cord had been used to keep the toe in a flexed position for a fortnight; a drop of nitric acid was applied daily to the internal and external surfaces of the bend. The cicatrisation following the ulcers thus caused kept the toe permanently flexed.

It appears that men who had volunteered to serve in the ranks furnished, in proportion to their numbers, the largest contingent. In the company referred to, 216 were volunteers, who form a very small proportion of the army as a whole. It has been proposed to send the offenders to a different arm of the service, in order to give them another chance, but experience has been decidedly unfavourable.

T. P. Smith.

Typhoid Bacilli in Butter and Buttermilk.—In *Le Caducée*, January 21st, 1905, Dr. Janssen gives an account of some experiments made by Dr. Brœrs, and recorded in the *Nederlandsch Tydschrift voor Geneeskunde*, November 12th, 1904. It has been shown by Heim and others that Eberth's bacilli placed in non-salted butter retain their vitality for indefinite periods. Bruch has proved that these bacilli placed in fresh milk pass into the butter made therefrom by churning the fresh cream. Brœrs wished to discover whether bacilli existed in butter made according to the method common in Holland, where sour milk is used, and salt added to the butter. It seemed probable that the lactic acid and the salt would, to some extent at least, destroy the microbes.

Brœrs made two sets of experiments. In the first he tried to determine for how long typhoid bacilli placed in butter such as is commonly sold in Dutch shops retained their vitality. In the second he placed typhoid bacilli in milk which was churned when sour, salt being added to the butter. In the first set of experiments it was found that the bacilli retained their vitality for two or three weeks. The addition of salt, therefore, has no effect upon the microbes. In the second set of experiments no bacilli were discoverable, either in the butter or in the buttermilk. Butter thus prepared cannot therefore be a medium for the propagation of typhoid fever.

T. P. SMITH.

The Wounds caused by the Japanese Rifle.—The *Deutsche Militärärztliche Zeitschrift*, for December, 1904, contains a translated summary of an article which appeared in the *Nowosti* of the previous month under the title of "The Humanity of the Japanese Rifle Bullets." The remarks are based on the statistics of cases treated in the Omsk Reserve Field Hospitals. Classifying the wounds according to the parts struck, it appears that in 42 per cent. the lower limbs were injured, wounds of the pelvis accounting for nearly one-half of these cases. Next in frequency come wounds of the tibia, 15·68; of the feet, 4·74; joints, 1·68. Wounds of the upper extremities constituted 27·74 per cent., the shoulder being the part most often injured.

In all these cases, with few exceptions, the course was favourable. As a general rule, there was no injury to large vessels and nerves; and, unless bones were comminuted, healing went on rapidly. As compared with former wars, the proportion of bone injuries was decidedly low, the difference being mainly due to the small calibre of the rifle and the velocity of the bullet. Sometimes the bones were simply perforated, without being shattered. Injuries complicated by severe damage to bones were almost always due to shrapnel bullets. When joints were perforated, healing usually went on well, without suppuration, the mobility of the part being eventually restored. In the hospitals referred to, excluding removal of a few fingers and toes, only one amputation was necessary; the forearm had been smashed by a shrapnel bullet.

In the next category, containing wounds of the thorax, abdomen and skull, the number in which the bullet traversed the cavities gave a percentage of 18·47. The favourable course was very remarkable. Many men wounded in the chest took little heed of their injuries, and some of them walked long distances to the dressing stations. A few complained of slight difficulty of breathing, and had bloody expectoration for a few days. Such wounds healed rapidly, perhaps in fourteen days. The prognosis is almost always favourable, unless the heart or large vessels are injured. Recovery ensued in one case, in which it was probable that the pericardium had been involved. As a general rule, in wounds of the abdomen, the course was equally favourable.

Mention is made of remarkable cases of perforation of the skull, the course of which was so favourable as to contrast markedly with former experience. There were seven cases of this kind. In one, the bullet entered in the middle of the forehead and passed out at the back of the neck. The man remained almost absolutely unconscious for a month, at Charbin. When brought to Omsk there were evidences of improvement.

It was noticed that he very slowly understood what was said to him, and paused some time before answering questions. In another case the bullet entered between the parietal and temporary bones, a little in front of the right ear, and passed out near the vertex. When taken to the Red Cross Hospital at Omsk there was paralysis of the left arm and leg, and speech was incoherent. Power over the leg was recovered in a month's time, and improvement, which bid fair to be progressive, had taken place in the arm.

T. P. SMITH.

Robert Koch, in a lecture published in the *Deutsch. Med. Wochensh.*, November 17th, 1904, after a short account of the discovery of the best known pathogenic protozoa, in which the work of Laveran, Ross, Bruce, Leishman, Donovan and others is duly acknowledged, gives a concise description of the more common trypanosomes and of the diseases resulting therefrom, which form the main part of the lecture. In this he first of all divides these diseases into two groups, the first comprising trypanosomiasis of rats and Theiler's disease in cattle; the other, tsetse-fly disease, Surra, Mal de Caderas, and the trypanosomiasis of man. The first group is, he states, distinguished by the constancy of the most important characters of the trypanosomes (among which he reckons their morphology, virulence, and behaviour towards their hosts) and the sharp way in which they are marked off from other trypanosomes.

Morphologically he shows that they can be distinguished with certainty from other trypanosomes. Their virulence, too, does not vary; it is neither increased nor diminished by repeated inoculations into animals. Their relations towards their hosts are also quite definite; the rat trypanosome can only be successfully cultivated in rats, and Theiler's trypanosome only in cattle. From these characteristics he concludes that they have been for a long time exclusively confined to their present hosts, have thus become intimately adapted to them, acquired constant characters, and become clearly defined species, resembling in these respects malarial parasites and the piroplasmata.

Very different is the behaviour of the trypanosomes of the second group. They cannot morphologically be sharply differentiated among themselves, their virulence varies within wide limits, and they are not exclusively confined to a definite host, thus justifying, in Koch's opinion, the conclusion that they have been living a comparatively short time in their hosts, have not yet become fully adapted to them, nor developed into distinct species.

Koch then offers some facts to substantiate his view as to the nature of the trypanosomes of his second group, limiting his remarks on this point to the parasite of tsetse-fly disease. These parasites are not with certainty to be distinguished morphologically from other trypanosomes; they are variable in size and shape when transferred to different animals. In the blood of rats, cattle and dogs they are proportionately small and have a blunt posterior end. In the blood of a horse, on the contrary, they are large and have a pointed, long-drawn-out end, like the trypanosome of the rat. In the blood of the rabbit and dog they have remarkably long flagellæ, while in that of the pig these are very short.

As regards the varying degree of virulence of this parasite Koch gives the two following examples :—

(1) A stallion and a mare from the Togo hinterland, intended for the Berlin Zoological Gardens, passed, on their way to the coast, through a tsetse-fly infected region, where they were probably infected. On arrival six weeks later trypanosomes were found in the stallion's blood. Both animals were transferred to the Institute for Infectious Diseases, where it was evident that the stallion was very ill—fever, anæmia and emaciation being noted. His condition gradually deteriorated, œdema was added, and death followed about four months after the date of the infection. During life trypanosomes were frequently found microscopically, and horses, asses, dogs, rats and mice infected at various times with its blood all developed the disease, and succumbed to it in a comparatively short time. The trypanosomes in the blood of this stallion possessed, therefore, a very high degree of virulence.

The mare, on the other hand, showed no signs of disease; careful and repeated microscopic examinations of the blood failed to reveal a single trypanosome, and the blood injected into rats gave negative results. Only after the injection of considerable amounts of the blood into the peritoneal cavity of young dogs was the presence of trypanosomes successfully demonstrated. The sparseness of the parasites in this animal's blood was shown by the fact that two dogs received 5 ccm. without ill-effects, but were infected with 20 ccm.

In all, nine dogs were thus infected. But whereas dogs inoculated with the stallion's blood always quickly succumbed, those which received the mare's blood developed only a mild attack. A single dog died after an illness of 102 days' duration, and others completely recovered, and later no parasites were found in their blood by microscopic examination. Horses, rats and mice inoculated from the Togo mare became only slightly or not at all ill.

How, asks Koch, is this extreme difference in virulence to be accounted for? Difference in disposition of the two animals was excluded by the fact that the mare, after being apparently well for nearly a year, proved as little resistant to the trypanosomes in the stallion's blood as the latter had been. He concludes, therefore, that the two strains of trypanosoma were widely divergent in virulence.

(2) A mining expedition in Rhodesia proceeding towards the Zambesi lost its way and strayed into a "fly-belt," where a horse and six asses were repeatedly bitten. The asses remained well, but the horse developed a severe attack of tsetse disease, and trypanosomes were found in its blood. It recovered, however, and six months afterwards, when transferred to Koch's experimental station at Bulawayo, it appeared quite well, and no parasites were found in the blood.

The trypanosomes from the blood of this horse, cultivated in the blood of dogs, rats and mice were, like those raised from the blood of the Togo mare, almost non-virulent. But as a very virulent form of tsetse disease is known to occur in the region where this horse was infected, we have here, again, highly virulent and almost non-virulent trypanosomes occurring together.

But the virulence of the tsetse parasite can be increased or diminished at will. Thus the almost non-virulent strain derived from the Togo mare acquired a very considerable increase of virulence by inoculation, first into a horse and then continuously into dogs. As already mentioned, a dog directly inoculated from this mare died in 102 days; another inocu-

lated in the second generation from a horse died in 113 days; and with the continuance of the inoculations the fatal course became shorter and shorter, until finally a duration of ten to fifteen days was reached, the same as was obtained after inoculation with the most virulent strain of tsetse trypanosome.

During these experiments the following very interesting observation was made. Three dogs, which had survived the first infection from the Togo mare itself, were afterwards successfully infected by the same strain of trypanosome when it had been rendered highly virulent by "passage" in dogs. They developed tsetse disease, and died just as if nothing had happened to them previously. This augmentation of virulence by "passage" in dogs was successful in a second series of experiments.

Koch brought about a reduction of virulence at Dar es Salam by passing trypanosomes, which were very virulent for cattle, through a rat and then through a dog. Inoculated, then, into two oxen, they caused only a slight and transient illness. Thus, in Koch's opinion the inconstancy in respect to virulence of tsetse trypanosomes is fully proved.

Finally he alludes to the fact that these parasites can be inoculated into almost all mammals which have been tested, to show that they have not yet completely accommodated themselves to their hosts. Even here variations are shown; sometimes they are more virulent for cattle, sometimes for horses, and sometimes for camels, &c.; so much so, that some observers, limiting themselves to this one peculiarity, have concluded that they had to deal with a special disease in each case. In reality, however, Koch states these were cultivations of the tsetse parasite by natural methods which, perhaps, when the trypanosomes shall have exclusively adapted themselves to a special host will lead to the formation of fixed characters. But for the present we have to do, in the diseases of the second group, with such innocent characters that it is difficult or impossible to make sharp distinctions between them.

For this reason Koch, in 1897, expressed the opinion that in Surra and tsetse-fly disease the disease processes might be identical, and although this view met with considerable opposition, further observation has only served to confirm it. He is all the more inclined to this opinion, as the assumed marks of distinction between these two diseases have recently lost in cogency. It was said that surra in India was little, and tsetse disease in Africa strongly, virulent for cattle. But, as we have seen, there are strains of the tsetse parasites which are very little virulent, while Surra, little virulent for cattle in India, may, when it spreads to other countries, become very virulent, as was especially seen in Mauritius.

Most recent authorities concur in Koch's opinion. Musgrave, who has made extensive researches on trypanosomiasis in Manilla, even argues in favour of the unity of Mal de Caderas, tsetse disease and Surra. On the other hand, Laveran and Mesnil, in their monograph on trypanosomiasis, advocate the separation, not only of the diseases enumerated under Koch's second group, but of tsetse disease into further entities. The immunisation experiments on which they base their argument are shown by Koch to have been faulty; but even if it were otherwise, their method cannot, he states, be used to distinguish the parasites of tsetse disease and Surra; otherwise, his two strains of trypanosome from the Togo mare, the non-virulent, and that of augmented virulence, must be regarded as belonging to two different disease processes.

To proceed on such principles would lead, Koch states, to the establishment of an interminable series of trypanosome diseases, like what used to exist in the case of malaria, and augment the confusion which already prevails.

Koch then discusses the prevention of tsetse disease by inoculations, and mentions that one of the oxen which he had inoculated at Dar es Salam with the attenuated virus was still immune after six years. He at first indulged the hope that this procedure would furnish a means of protecting cattle against tsetse disease, but further study of the pathogenic protozoa showed that immune animals, far from being free from parasites, as was at one time supposed, regularly harboured them for considerable periods after immunity was established. Thus cattle immune to Texas fever communicate it to susceptible animals, and Koch showed, in Rhodesia, where his experimental cattle were drawn from a Texas fever region, that the piroplasmata were present in the blood of 10 to 15 per cent. of these animals. The same holds good for the coast fever of Rhodesia, the piroplasmata of dogs and horses, and the disease of cattle in Transcaucasia (Dschunkowski).

Koch maintains that animals rendered immune to trypanosomes also have these parasites in their blood, as he showed in rats, as appeared from the condition of the Togo mare, and as was shown by Bruce in the case of healthy antelopes and buffaloes in tsetse-fly regions. In the case of the immune ox at Dar es Salam, parasites could not be found by the microscope, but experiments on dogs proved their presence.

Hence, in Koch's opinion, to attempt to immunise whole herds of cattle in the above manner would only lead to the establishment of further permanent sources of infection. He then discusses other measures of prevention, and in the case of the tsetse-fly disease, he holds that it is for consideration, in given cases, whether it is more advantageous to have a good stock of game or a good stock of cattle, since both together are incompatible in Africa. He advocates the destruction, slaughter or isolation of all animals found to harbour trypanosomes in their blood, and illustrates the advantages of these measures by the examples of Java and Mauritius.

In Mauritius, Surra, introduced from India, was not recognised until late, and when it was recognised, rational measures were not taken against it. In consequence, the whole of the horses and mules and the greater part of the cattle were destroyed within two years. In Java, on the other hand, the imported disease was soon correctly diagnosed and energetic measures immediately taken to stamp it out. Stables and sheds were improved, sick animals were slaughtered, and the suspected isolated, and by these means the disease, which was in course of becoming widespread, was brought to a standstill.

In accordance with these principles, which have proved effective in other infectious diseases, we should, in future, combat the diseases produced by trypanosomes, but unfortunately they cannot be applied to the trypanosomiasis of man. It would not be difficult to isolate in hospitals the actually sick, but impossible to treat the thousands of apparently healthy "suspects" in the same way.

Nor do we possess a remedy which can destroy the trypanosomes in the blood. Arsenic, which has been used for a considerable time, gives poor results, Ehrlich's trypan-red produces a considerably better effect

on the trypanosome than arsenic; and still better results have been obtained by Laveran and the investigators of the Liverpool School of Medicine by a combination of the two. Again, Windelstadt[1] has found that malachite-green exercises a destructive action on the trypanosome of animals. But all these researches are still in the stage of laboratory experiment.

G. COUTTS.

Sugar as a Food: Indications and Contraindications for its Use. —In *Le Caducée*, January 21st, 1905, Dr. Boigey returns to this subject, and criticises the opinions expressed on his article in the same paper just a year ago (JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, vol. iii., pp. 109 and 568). In Boigey's experiments, twenty healthy men received 40 grammes of sugar daily for one month. Sixteen increased in weight; of these, two complained of gastric disorders and five of weakness. A second set of experiments gave the same results, with the addition that some of the men complained of thirst, and that in two cases the urine contained 3 grs. of glucose. It would therefore appear: (1) That for persons in health excess of sugar can do no good whatever. The case is, however, different when hard and continuous work is being imposed on the persons taking the excess of sugar. (2) The absorption of the excess may overtax the power of the liver, with glycosuria as the result. (3) Sugar ought to be very sparingly administered to tuberculous subjects. Guinard (*Semaine Médicale*, 1900, p. 287) has shown that animals inoculated with tubercle and fed with sugar succumb much more rapidly than others fed in a normal manner. This observation supports the opinion of Tourtalis Bey, who attributes the extraordinary extension of tuberculosis and the gravity of its manifestations amongst the Egyptians to their consumption of large quantities of sugar.

According to Boigey there are two indications for the administration of sugar in large doses:—

(1) Cases of disease, and especially of fever. Ragot has shown that 100 grammes of sugar given daily in a case of fever lessened the destruction of nitrogenous materials, preserved from consumption about 50 grammes of albumen daily, and consequently checked the production of toxins resulting from the feeding of the body on its own proteids and fats.

(2) Cases in which great muscular efforts are about to be required. Where there is rapid perversion of normal metabolism and consumption, or exhaustion of the tissue elements, sugar may prove very useful. Boigey suggests that for soldiers during courses of instruction, manœuvres and campaigns, and likewise for sportsmen, a special "fatigue ration" should be prepared, containing an additional 40 to 70 grammes of sugar.

T. P. SMITH.

[1] "On the Action of Malachite-Green, &c., on Nagana Trypanosomes in White Rats," *Deutsch. Med. Wochenschr.*, November 17th, 1904.

Correspondence.

A *POST-MORTEM* EXAMINATION IN A FATAL CASE OF BULLET WOUND OF THE ABDOMEN.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

DEAR SIR,—With regard to the criticism Surgeon-General Stevenson appended to my article upon "*Post-mortem* Examination in a Fatal Case of Bullet Wound of the Abdomen," I would like to make, with your kind permission, the following observations.

The descriptions of all skin points on the trunk, except those in relation to the nipples and the umbilicus, are vague by compulsion; and I am afraid the skin point described by me "just above and a little in front of the highest point of the crest of the ileum" gives full play to the imagination in all its parts. "A little in front of" is vague, and so is the highest point in the sweeping curve of the iliac crest. Therefore I am sorry that Surgeon-General Stevenson did not attempt to follow in his *post-mortem* investigations the exact course through the cæcum and sigmoid flexure which was taken by the bullet in the case I described. Before going further I would like to say that there can be no doubt that bullets of high velocity in passing across the abdomen probably penetrate every object they encounter. I am not so sure that bullets of extremely low velocity, as in my case, will behave in the same way. Further, I do not think it is sufficiently realised that the slightest variation in the *levels* at which the different bullets enter cause the greatest varieties in the precise objects or parts of objects encountered, even when their *directions* are identical, that is to say, whether they are transverse or antero-posterior, &c.

It is difficult to appreciate how true is this statement until one performs actual shooting experiments upon the abdomen of a dead body, the viscera of which have been undisturbed and fixed in formalin.

Mr. Arthur Keith and I showed this in two bullet wounds which we recently made in the abdomen of a male body. The experiments were made to bear upon my case: the first shot (Lee-Enfield) was fired from right to left, so that the wound of entrance was made at a point immediately above and in front of the highest point of the iliac crest. The direction taken by the bullet was not quite transverse, as was intended, but slightly oblique, so that the wound of exit was a quarter of an inch in front of the wound of entrance.

This bullet passed through the posterior wall of the ascending colon, the vertebral column, it did not again enter the peritoneal cavity, and missed the descending colon behind which it travelled. This course somewhat resembles that taken in Surgeon-General Stevenson's hypothetical case, except that the posterior aspects of the ascending and descending colons with the viscera in point instead of the cæcum and sigmoid flexure, as he asserts. In my case the wound of exit in the cæcum can be seen three-quarters of an inch in front of the ileum, as it passes upwards and to the right in juxtaposition to the cæcum to terminate at the ileo-cæcal valve, and

the wounds of entrance and exit in the upper part of the sigmoid flexure can be seen situated in the anterior wall, only a narrow strip of which separates the two holes; in fact, the anterior wall was nearly torn away. Mr. Keith and I arranged our second shot so that it not only should take a transverse direction, but also that it should hit as nearly as possible the same viscera in the same places as in my case. To accomplish these objects the bullet entered the skin about three-quarters of an inch in front of the skin wound of entrance made by our first bullet, and still could be described rightly as "a little in front of and above the highest point of the iliac crest." As it progressed the bullet penetrated the cæcum in almost the same places as in my case, but a little higher. Then a coil of small intestines lying in contact with it was perforated. Next it passed immediately behind the right and left common iliac arteries, tearing away the posterior wall of the artery on the right side. After leaving this part it passed through a coil of small intestine which was lying in front of the subjacent and contracted sigmoid flexure, the fat and atrophied appendices epiploicæ on the anterior wall of the sigmoid, which was grazed by the bullet before it ultimately emerged opposite the wound of entrance. There can be no doubt that the track of the high velocity bullet in our second experiment resembled the course taken by the bullet in my case, except that in the latter there were no wounds discoverable in the peritoneum covering the posterior parietes, neither were there any wounds of *penetration* seen after careful search in the mesentery and small intestines; and at the time of making the *post-mortem* examination I thought that the bullet probably passed in front of the narrow attachment of the mesentery in this region, and that the extreme lowness of velocity of the bullet in my case might explain the absence of penetration in the small intestines.

However, I do not wish to theorise about the case, and I should welcome any criticism made by Surgeon-General Stevenson upon my statements, provided it is founded upon actual shooting experiments, which are arranged to hit the same viscera in the same places as those struck in my case and performed upon the undisturbed abdomen. I believe, with all due respect to him, one single experiment on these lines will have more value than any number of fictitious cases concocted from theories and opinions which have been based upon any other form of test.

I hope that if another opportunity should arise, the R.A.M.C. may see its way to organise a little band of accurate observers, which should do nothing else than note the exact results in cases rendered fatal by any missile used in war; unless the report of the Japanese Army Medical Department has by that time rendered it a task of supererogation.

I have the honour to be,
Yours faithfully,

January 25th, 1905. G. Lenthal Cheatle.

JOURNAL

OF THE

ROYAL ARMY MEDICAL CORPS.

Corps News.

MARCH, 1905.

GAZETTE NOTIFICATIONS—ARMY MEDICAL SERVICE.

Surgeon-General W. J. Fawcett, M.B., C.B., Army Medical Staff, to be Deputy Director-General, vice Surgeon-General A. Keogh, M.D., C.B., appointed Director-General, dated January 20, 1905.

ROYAL ARMY MEDICAL CORPS.

Lieutenant H. B. Connell is seconded for service under the Foreign Office, dated December 31, 1904.

Colonel J. M. Beamish, M.D., is placed on retired pay, dated January 26, 1905. Colonel Beamish entered the Service April 1, 1871; was promoted Surgeon March 1, 1873; Surgeon-Major April 1, 1883; Surgeon-Lieutenant-Colonel April 1, 1891; Brigade-Surgeon-Lieutenant-Colonel, February 27, 1895; and Colonel December 9, 1898. His war services are as follows: Afghan War, 1878-9. Served with 1st Division Siege Train, Kabul Expeditionary Force in Dadur and the Bolan Pass. Medal. Burmese Expedition, 1885-6. Medal with clasp.

Lieutenant-Colonel C. B. Hill is placed on temporary half-pay on account of ill-health, dated January 29, 1905.

The undermentioned Lieutenants to be Captains: W. J. S. Harvey, dated January 14, 1905. B. A. Craig, dated January 29, 1905.

The undermentioned Captains to be Majors, dated January 30, 1905: C. T. Samman, H. A. Berryman, C. G. Spencer, M.B., C. E. P. Fowler, T. H. J. C. Goodwin, D.S.O., A. E. C. Keble, D. J. Collins, M.B., J. B. Anderson.

Captain R. E. G. Phillips, from the seconded list, to be Captain, dated February 1, 1905.

Lieutenant R. G. Anderson, from the seconded list, to be Lieutenant, dated January 30, 1905.

Lieutenant-Colonel G. D. Hunter, D.S.O., is seconded for service with the Egyptian Army, dated February 2, 1905.

ROYAL ARMY MEDICAL COLLEGE.

The undermentioned Captains qualified for promotion at the recent examination at the Royal Army Medical College: R. J. Blackham, Specialist in Midwifery and Gynæcology; H. Hewetson, Specialist in State Medicine; J. McD. McCarthy, Specialist in State Medicine; H. G. Martin, Specialist in Midwifery and Gynæcology; F. F. Carroll, Specialist in Advanced Operative Surgery; J. D. G. Macpherson; S. de C. O'Grady, Specialist in State Medicine; A. H. O. Young; G. B. Carter; P. H. Collingwood; S. O. Hall, Specialist in Midwifery and Gynæcology; A. E. Weld, Specialist in Midwifery and Gynæcology; H. M. Nichols; L. N. Lloyd, D.S.O.; O. Challis; G. T. K. Maurice, Specialist in Pædiatrics.

RETIRED PAY APPOINTMENTS.

The following retired pay appointments are vacant: Lincoln, Sheffield, Halifax, Beverley, Warrington, Bodmin, Brecon, Cardiff, Stirling, Perth, Berwick, Glencorse, Omagh, Derby, Londonderry, Fleetwood, Pontefract, Armagh.

the officials of the Pretoria Cycling and A.A.A. (two of whom acted as timekeeper and starter). The gathering is always a popular one, as the Corps is well represented in all branches of sport in Pretoria. A fine cup was presented by Mr. T. W. Beckett for a Championship prize, and there were nine special prizes, presented by outside friends, in addition to the ordinary prizes. The cup was won by Corporal Winn with 15 points, the winner of the prize for the 'runner-up' being Private Miller with 10 points. The times would have been better had there not been a strong breeze blowing. Entries for the open events were large, but it will be noticed that the first and second in the Open Mile were Corps men. At the conclusion the prizes were presented by Mrs. Dallas Edge, wife of Surgeon-General J. Dallas Edge, Principal Medical Officer, South Africa, the winner and runner-up for the cup being 'chaired' by their comrades. The fine band and pipers of the 2nd Cameron Highlanders were in attendance, and were a feature of the afternoon. A word of praise should also be said for the popular Secretary, Sergeant Robinson, R.A.M.C., who was indefatigable throughout the meeting."

PRIZE LIST.

Throwing the Cricket Ball: Private Lee, Lance-Corporal Mackenzie, Private Mannion.

Tug of War: Corporal Godden's Team.

Hundred Yards: Corporal Winn, Private Fleckney, Private Miller. Time, $11\frac{4}{5}$ seconds.

Dribbling the Football: Private Craig, Private Morrison.

Long Jump: Private Lee, Lance-Corporal Mackenzie, Corporal Winn. Distance, 16 feet $6\frac{1}{4}$ inches.

One Mile: Private James, Private Roe, Private Morrison. Time, 5 minutes $24\frac{4}{5}$ seconds.

Putting the Shot: Private Crowe, Lance-Corporal Mackenzie, Private Lee. Distance, 28 feet $8\frac{1}{2}$ inches.

Three-legged Race: Privates Sells and Roy; Alger and Hardie; Griggs and Loasby.

High Jump: Private Miller, Private Crowe, Lance-Corporal Mackenzie. Height, 4 feet 9 inches. Easy win.

Quarter Mile: Corporal Winn, Private Miller, Private Fleckney. Time, 60 seconds.

Sack Race: Privates Hardie, Craig, Loasby.

Half Mile (open to Corps in South Africa): Privates Roe, James, Dale (all Pretoria). Time, 2 minutes 23 seconds.

Boot Race: Privates Holden and Craig.

One Hundred and Twenty Yards Hurdles: Lance-Corporal Mackenzie, Corporal Winn, Private Miller. Time, $20\frac{4}{5}$ seconds.

Relay Race (Open): Northern Rifles, Transvaal V.M.S.C., 2nd Cameron Highlanders. Time, 3 minutes 52 seconds. A fine race.

Two Hundred and Twenty Yards (open to Corps in South Africa): Corporal Winn, Private Miller, Private Fleckney (all Pretoria). Time, $27\frac{3}{5}$ seconds.

Officers' Race: Captain Simson, Lieutenant Lambert, Lieutenant Lewis.

Old Soldiers' Race: Sergeant Casely, Sergeant Shaw, Sergeant-Major Bollen. The latter was winning easily, but fell.

Open Mile: Staff-Sergeant Timbrell, R.A.M.C., Private Roe, R.A.M.C., Private McNicoll, 2nd Cameron Highlanders. Time, 5 minutes $16\frac{3}{5}$ seconds.

Band Race: Sergeant Lawson, Bandsmen Rarity and Gibbons.

Open 100 Yards: Private Bailey, Queen's Bays, Lance-Corporal C. Skeet, Lance-Corporal A. Skeet, 2nd Cameron Highlanders.

Obstacle Race: Lance-Corporal Mackenzie, Private Craig, Private Butterworth.

Committee Race: Mr. Stone, Mr. Bindon, Corporal Burn.

Harriers' Race (run December 15): Private Ginger, Private Roe, Private James. A very keen competition, twelve turning out. Private Ginger was scratch; although favourite, he only just beat Roe, who was the dark horse, and surprised everyone by his form.

NOTES FROM SIMLA, INDIA.—Captain E. Blake Knox, R.A.M.C., writes: "Colonel Saunders, R.A.M.C., has been appointed officiating Principal Medical Officer, Eastern (late Bengal) Command, with the temporary rank of Surgeon-General, vice Surgeon-General Burnett, officiating Principal Medical Officer, His Majesty's Forces, India, pending the return of Surgeon-General Sir Thomas Gallwey. Lieutenant Small-

man, R.A.M.C., has arrived, and every facility is being given to him to continue his researches into the inoculations against enteric fever carried out at Aldershot in the regiment to which he was specially attached by the home authorities. Lieutenant-Colonel Hathaway has been appointed to the command of the Station Hospital, Poona.

"Officers in the Corps should note that the nomenclature of the Indian Commands have been changed by order of His Excellency the Commander-in-Chief. Punjab becomes the Northern Command; Bombay becomes the Western Command, and Bengal the Eastern Command. Madras is abolished as a command, and its several stations, except Belgaum, taken under Secunderabad, which becomes Secunderabad Division. Burma becomes Burma Division. Aden becomes a brigade under the Western Command.

"Full use, with extra pay, is being made of R.A.M.C. officers who have qualified as specialists in promotion examinations at the R.A.M.C. Staff College at home; as they arrive in India they are appointed from Army Headquarters to suitable appointments. Besides the divisional laboratory appointments, there are no less than fifty-five others in various subjects, and the supply of specialists arriving is not sufficient to meet our requirements."

Captain Blake Knox notifies his appointment as Secretary, R.A.M.C., to the Principal Medical Officer, His Majesty's Forces in India, with effect from December 11, 1904.

NOTES FROM MALTA. — Captain J. Crawford Kennedy, R.A.M.C., writes: "Christmas time in Malta went off with the usual round of entertainments in the various hospitals, and the detachments at Valletta and Cottenera vied one with the other in giving really good smoking concerts. At the former, Colonel Wolseley presented the cricket prizes for last season. The bat was secured by Private Fish, and the ball by Private Hawes.

"The Officers' Dinner, held on December 21, was a great success. Several guests were present; the guest of the evening was Deputy Inspector-General Bentham, the newly-arrived Principal Medical Officer of the Royal Naval Hospital, Bighi. One of the toasts was that of the health of our late Director-General, Sir W. Taylor, proposed by Colonel Wolseley, and received with much enthusiasm.

"The following interesting papers have been read at the Officer's Monthly Meetings: 'Treatment of Chronic Middle Ear Suppuration,' and 'Physiological Exercises for the Restoration of Misused Voices,' both by Major Austen; 'Double Infection by Enteric and Malta Fevers,' by Captain Kennedy. This case was proved by splenic cultures after death from enteric perforation. It is believed that this is the first case on record.

"At the last meeting, Lieutenant-Colonel Sloggett showed the chart of a case that, on admission, reacted only to enteric, and now (one month after) reacts to both enteric and malta fevers.

"Captain Masters and Bostock are under orders for Crete, to relieve Captains Cunningham and Bransbury. Captain Cunningham is due to go home, tour expired. Captain Bateman has arrived from Egypt for duty. Captains Pollock and Fleury are expected here shortly. Colonel Jennings and Captain Ryan are still on sick leave."

NOTES FROM NETLEY.—Lieutenant-Colonel G. E. Twiss, R.A.M.C., writes: "Lieutenant-Colonel G. H. Sylvester is acting Principal Medical Officer during the absence on leave of the Surgeon-General from January 20 to March 21, 1905.

"Captains Hime and Crisp have left for the course at the Royal Army Medical College.

"The following officers have joined for duty, and have become subscribers to the Royal Army Medical Corps Fund: Lieutenants D. D. Paton, H. T. Wilson, W. H. Hills, J. F. C. Mackenzie, H. C. Winckworth, F. J. H. Luxmoore, P. A. Jones, G. H. Richard, J. St. A. Maughan."

NOTES FROM ST. HELENA.—Major C. E. G. Stalkartt, R.A.M.C., writes: "A partial change of garrison took place on the arrival of the 53rd Company Royal Garrison Artillery, from India, which replaced the 47th Company Royal Garrison Artillery, and which latter embarked for home in October, 1904, on the Home Transport 'Dunera.' Lieutenant O. Ievers, R.A.M.C., arrived from the Cape in November, 1904, for duty in St. Helena, and Civil Surgeon D. Ritchie proceeded to England.

"The medal for Long Service and Good Conduct was presented to No. 7251 Staff-Sergeant G. Jones, R.A.M.C., after church parade service, by the Senior Medical Officer on Sunday, January 8, 1905. The troops (including detachments of the Royal

Garrison Artillery, the Royal Engineers, the Lancashire Fusiliers, and the R.A.M.C.) being drawn up on three sides of a square facing the Station Hospital, under the command of the senior officer present, Major C. E. Grey Stalkartt, Senior Medical Officer, after bringing to notice of all on parade the irreproachable character and exemplary conduct as a soldier of Staff-Sergeant Jones (as testified to by the fact of his having an absolutely clear company defaulter sheet after 18¾ years' service), complimented the recipient of the honour on being 'not only a credit to the R.A.M.C., but also an ornament and a pattern to His Majesty's Army.'

"Lieutenant O. Ievers made his *debut* on the Island as a cricketer by playing for the Half-Tree Hollow Cricket Club, which on this occasion placed another victory to its credit against the Sandy Bay Cricket Club. Last week a Garrison Eleven scored an easy win against a representative Island Eleven."

NOTES FROM THE WESTERN DISTRICT.—Major C. J. W. Tatham, R.A.M.C., writes: "The following officers have recently joined at headquarters for duty in the district: Lieutenant-Colonel M. Dundon, Major F. H. Corkery, Captains S. G. Butler, P. MacKessack, W. P. Gwynn, J. J. W. Prescott, D.S.O., F. E. Carroll, A. E. Weld, and Captain and Quartermaster F. Crooks.

"The undermentioned officers have left us either on retirement or for foreign service: Lieutenant-Colonel H. E. Deane (retired); Major N. Manders for Mauritius; Majors F. S. LeQuesne, V.C., H. M. Adamson, A. E. Winter, and Lieutenant D. P. Watson for India; Major S. F. Clark for South Africa; Captains A. E. Master for Malta: J. P. Silver for Barbadoes; Quartermaster and Honorary Major D. J. Gillman (retired); Lieutenant-Colonel J. E. Williamson (R. P.) has been transferred from Bull Point, Devonport, to Leicester.

"A meeting of the R.A.M.C. Medical Society was held in the Officer's Library on January 27; Colonel G. D. Bourke, R.A.M.C., was in the chair.

"Up till recently there had been so few officers at headquarters that it had not been possible to arrange a meeting of the society earlier.

"Lieutenant-Colonel M. Dundon read notes of an obscure case, the symptoms in which pointed to intrathoracic tumour, and which after death was found to be a case of aneurysm of the descending aorta. It was impossible to make a certain diagnosis during life.

"'Colour-Sergeant S., admitted last November, complaining of severe pain at the left side of spine over the seventh and eighth ribs near their angles. Previous history was good, except that he had an entry for syphilis in 1899.

"'*Physical signs* show dulness over the whole of the base of left lung, more marked posteriorly than laterally; absence of breath sounds, decreased resonance and defective expansion of whole of left chest. Heart normal in position and action; no albumen in urine. There has been since admission but little change in the physical signs, but the heart is now displaced upwards and inwards a little, and he complains only of the persistent pain. He is steadily losing weight No increase of pulse rate or respiration; no pyrexia.

"'Evidence of fluid being present in left pleura, he was aspirated on January 13, and two points of turbid yellow-coloured fluid withdrawn, which had the general characters of a transudate rather than an exudate.

"'The diagnosis rests between (*a*) intrathoracic tumour; (*b*) aneurysm; (*c*) tubercular pleuritis; (*d*) chronic pleurisy with thickened pleura; (*e*) hydatids.'

"The case evoked considerable discussion, the balance of opinion seemed to be that it was not tubercular, but that rather the symptoms were due to pressure, caused either by an aneurysm or a new growth. He died on February 6.

"The *post mortem* revealed a fusiform aneurysm of the descending aorta behind the heart. This eroded the left side of the bodies of the second, third, and fourth dorsal vertebræ, and ends of corresponding ribs. The intervertebral discs were uninjured. The aneurysm was about 3½ inches long, and about the diameter of a hen's egg at its greatest width. It contained no clot, and the rupture occurred on the posterior aspect of the sac. The left pleural cavity contained about two pints of recent blood clot, and a small quantity of organised blood clot behind the apex of left lung. The valves of heart were healthy, and there was marked hypertrophy of the left ventricle. The abdominal aorta was normal.

"Captain Butler read a paper on damaged and loosened semi-lunar cartilages of the knee joint. After a brief description of the anatomy of the knee-joint, he read the description by Tenney, of Boston, of the dissection of 150 knee-joints, and statistics

showing the condition found in 128 operations for loose cartilage by various surgeons. These showed that the internal cartilage was the more frequently and the more severely damaged, and also that the damage is much less than is commonly supposed.

"He suggested that the initial lesion was a tearing of the internal lateral cartilage, and that this allowed of some movement of the cartilage, which was given further play by the distension of the capsular ligament from effusion into the joint. This condition, he thought, would be found in the majority of simple sprains of the knee-joint followed by synovitis, and if it was allowed to recur the cartilage eventually became damaged. This could be obviated by ensuring complete rest, with passive movement of the joint until all lateral movement had disappeared, combined with daily massage of the capsular ligament and the muscles connected with it.

"Most of the officers present took part in the dissussion which ensued, and concurred in the views expressed in the paper, though there was a tendency to think that not all cases of synovitis were due to such a severe injury."

NOTES FROM WOOLWICH.—Lieutenant-Colonel M. O'D. Braddell, R.A.M.C., writes: "The Christmas festivities were duly observed at the Royal Herbert Hospital, the wards being most artistically decorated. Lieutenant-Colonel Whitehead and the other officers of the Hospital visited each ward while the patients were at dinner, and wished them 'A Happy Christmas.' The cooks of the Hospital deserve great credit for the manner in which they prepared a substantial and varied fare. Afterwards the men of No. 12 Company sat down to their dinner in the Company Dining Hall, which was most tastefully decorated, as were also the Barrack-rooms, where expressions of good wishes to Lieutenant-Colonel Whitehead and the other officers were conspicuous. On the day following an excellent concert for the patients was held in the dining room of the Hospital, the Matron and Sisters doing all in their power to make it the complete success which it was. On the afternoon of December 29 a children's tea, followed by a Christmas tree and magic lantern entertainment for the wives and children of the N.C.O.'s and men of No. 12 Company, R.A.M.C., was held, and was much enjoyed by all. Mrs. Whitehead, assisted by Mrs. Merritt, took endless trouble in making all the arrangements and purchasing suitable toys for the children, who gave hearty cheers for Colonel and Mrs. Whitehead at the conclusion of the entertainment. All the other ladies of the Corps were present, and assisted in looking after the wants of the little ones.

"Lieutenant-Colonel Forman has arrived, and will shortly take over charge of the Hospital and Principal Medical Officer, Woolwich District, as Lieutenant-Colonel Whitehead proceeds to India on promotion. Captain John M. Buist sails for South Africa on February 17 to take up an appointment as Sanitary Officer. He has recently obtained the D.P.H., Cambridge, and also the degree in Tropical Medicine. Lieutenant Rugg has been appointed to the Egyptian Army, and proceeds to Cairo on the 10th prox. Lieutenant-Colonel T. D. T. Reckitt, in charge of the Auxiliary Hospital, sails for India on the 27th inst. Major A. E. Morris has assumed temporary charge *vice* Lieutenant-Colonel Reckitt. Sergeant-Major Tothill has arrived to relieve Sergeant-Major Soule, who goes to Mauritius; he carries with him the best wishes of every one connected with the Hospital."

QUEEN ALEXANDRA'S IMPERIAL MILITARY NURSING SERVICE:—

Appointments.—As Staff Nurses: Miss A. B. Cameron, Wynberg, Cape Colony; Miss H. M. E. Macartney; Miss E. M. Rentzsch; Miss S. O. Beamish; Miss E. C. Armstrong; Miss A. C. Mowat; Miss E. M. Lang, to Lincoln for temporary duty; Miss M. Antrobus; Miss K. Roscoe; Miss A. A. Steer; Miss F. E. Davies; Miss M. M. A. Copinger; Miss M. Davis; Miss C. D. E. F. Dunn; Miss H. Hartigan.

Resignations.—The following Staff Nurses have resigned their appointments: Miss F. E. C. Watson and Miss A. S. Wyatt.

Changes of Station.—Matrons: Miss C. M. Chadwick, R.R.C., to Curragh on expiration of leave; Miss M. Russell, R.R.C., to Alton on expiration of leave; Miss M. Thomas, R.R.C., to Dover on return from South Africa. Sisters: Miss M. M. Blakely, to Egypt from Curragh; Miss A. FitzGerald, to Cambridge Hospital, Aldershot, on return from Indian Troopship Service; Miss S. Lamming, to Cadet Hospital, Royal Military Academy, Woolwich; Miss D. I. Rickards, to Royal Herbert Hospital, Woolwich, on expiration of leave; Miss E. C. Humphreys, to Transport "Plassy," for Indian Troopship Service, from Cambridge Hospital, Aldershot.

Appointments Confirmed.—Staff Nurses: Miss H. M. Drage, Miss B. Rennie, Miss L. M. Toller, Miss L. F. A. Waller.

ARMY MEDICAL RESERVE OF OFFICERS.

Surgeon-Major S. Linton, M.B., having resigned his Commission in the Volunteers, ceases to belong to the Army Medical Reserve of Officers, dated January 28, 1905.

Surgeon-Lieutenant P. J. O'Sullivan, 1st City of London Royal Garrison Artillery (Volunteers), to be Surgeon-Lieutenant, dated February 4, 1905.

ROYAL ARMY MEDICAL CORPS (VOLS.).

The Manchester Companies.—The surname of Quartermaster Harold Thomson is as now stated, and not as described in the *London Gazette* of December 23, 1904.

The Woolwich Companies.—Major C. H. Hartt is granted the honorary rank of Lieutenant-Colonel, dated January 28, 1905.

Captain (Honorary Captain in the Army) M. Taylor, M.B., is granted the honorary rank of Major, dated January 28, 1905.

The London Companies.—Lieutenant H. S. Collier resigns his Commission, dated February 11, 1905.

OTHER VOLUNTEER CORPS.

The Mersey Division, Submarine Miners.—Surgeon-Lieutenant R. Jones resigns his Commission, dated January 21, 1905.

1st *Roxburgh and Selkirk* (*the Border*).—Supernumerary Brigade-Surgeon-Lieutenant-Colonel G. H. Turnbull, M.D. (Senior Medical Officer, Scottish Border Volunteer Infantry Brigade), is granted the honorary rank of Surgeon-Colonel, dated January 21, 1905.

4*th* (*Stirlingshire*) *Volunteer Battalion Princess Louise's* (*Argyll and Sutherland Highlanders*).—Surgeon-Lieutenant T. Beard to be Surgeon-Captain, dated January 21, 1905.

1st *Fifeshire Royal Garrison Artillery* (*Volunteers*).—Surgeon-Captain H. W. Laing, M.D., resigns his Commission, dated January 28, 1905.

2*nd Volunteer Battalion the Norfolk Regiment.*—Surgeon-Captain S. J. J. Kirby, from the 2nd Volunteer Battalion the Suffolk Regiment, to be Surgeon-Captain, dated January 28, 1905.

1st *Volunteer Battalion the Loyal North Lancashire Regiment.*—Frederick Thomas Walmsley, Gent., to be Surgeon-Lieutenant, dated January 28, 1905.

1st *Volunteer Battalion the Northamptonshire Regiment.*—George Herbert Lewis, Gent., to be Surgeon-Lieutenant, dated January 28, 1905.

16*th Middlesex* (*London Irish*).—Surgeon-Captain C. R. Keyser resigns his Commission, dated January 7, 1905.

1st *Essex Royal Garrison Artillery* (*Volunteers*).—William Douglas Watson, Gent., to be Surgeon-Lieutenant, dated February 8, 1905.

5*th* (*The Hay Tor*) *Volunteer Battalion the Devonshire Regiment.*—Surgeon-Lieutenant-Colonel W. H. Webb, M.D., is granted the honorary rank of Surgeon-Colonel, dated February 8, 1905.

1st (*Brecknockshire*) *Volunteer Battalion the South Wales Borderers.*—Surgeon-Lieutenant-Colonel P. E. Hill (Brigade-Surgeon-Lieutenant-Colonel, Senior Medical Officer, South Wales Border Volunteer Infantry Brigade) is granted the honorary rank of Surgeon-Colonel, dated February 8, 1905.

1st *Bucks.* — Supernumerary Surgeon-Lieutenant-Colonel W. H. Bull (Brigade-Surgeon-Lieutenant-Colonel, Senior Medical Officer, Home Counties Volunteer Infantry Brigade) is granted the honorary rank of Surgeon-Colonel, dated February 8, 1905.

4*th Volunteer Battalion the Devonshire Regiment.*—Surgeon-Major J. R. Thomas, M.D. (Brigade-Surgeon-Lieutenant-Colonel, Senior Medical Officer, Devon Volunteer Infantry Brigade), to be Surgeon-Lieutenant-Colonel, dated February 10, 1905.

Surgeon-Lieutenant-Colonel J. R. Thomas, M.D. (Brigade-Surgeon-Lieutenant-Colonel, Senior Medical Officer, Devon Volunteer Infantry Brigade), is granted the honorary rank of Surgeon-Colonel, dated February 11, 1905.

2*nd Volunteer Battalion the East Surrey Regiment.*—Surgeon-Lieutenant-Colonel W. Gandy (Brigade-Surgeon-Lieutenant-Colonel, Senior Medical Officer, East Surrey Volunteer Infantry Brigade) is granted the honorary rank of Surgeon-Colonel, dated February 11, 1905.

3*rd* (*Dundee Highland*) *Volunteer Battalion the Black Watch* (*Royal Highlanders*).—Surgeon-Lieutenant A. K. Traill resigns his Commission, dated February 11, 1905.

1st Volunteer Battalion the Essex Regiment.—Surgeon-Lieutenant J. Aitken, M.B., to be Surgeon-Captain, dated February 11, 1905.

13th Middlesex (*Queen's Westminster*).—Surgeon-Captain W. Rose, M.B., resigns his Commission, dated February 11, 1905.

DISTRIBUTION OF PRIZES, LONDON COMPANIES, ROYAL ARMY MEDICAL CORPS (VOLS.).

London Companies.—The Annual Prize Distribution took place at the headquarters of these Companies, on Saturday, February 18, the prizes being given away by Mrs. Keogh.

Amongst those present were Surgeon-General A. Keogh, C.B., Director-General A.M.S., Lieutenant-Colonel W. Babtie, V.C., C.M.G., Major T. McCulloch, R.A.M.C., Lieutenant-Colonel M. W. Russell, R.A.M.C., Major H. C. Thurston, C.M.G., Colonel H. E. R. James, R.A.M.C., Mr. Edmund Owen, Mr. Makins, Dr. Tirard, and Brigade-Surgeon-Lieutenant-Colonel W. R. Smith.

Lieutenant-Colonel V. Matthews, after welcoming Surgeon-General Keogh to one of the first public functions since he became Director-General, stated in his progress report that on October 31, 1904, the strength of the Companies was 332, as compared with 380 on the same date the previous year. Every effort had been made to get recruits of the class required by these Companies, and the smallness of the numbers of recruits was due, in his opinion, chiefly to the compulsory camp. Colonel Matthews thought it might be worth while for the authorities to try the effect of abrogating for a time the compulsory camp clause, bearing in mind the larger numbers attending camp before it was compulsory. Formerly these Companies had been able to get a certain number of medical students to join, and had supplied some good officers of the Royal Army Medical Corps, but very few joined now. He pointed out the value of the training to medical students, more particularly if they entered the Service afterwards. Two members of the Corps had obtained commissions in the Royal Army Medical Corps at the last examination (Messrs. Hoare and Churchill). Thanks to Major Gibbard, whom he was sorry to say they were soon to lose, a most instructive year's training had been carried out. The riding and driving instructions for the transport section had been reorganised, and a cyclist section had been formed. He was glad to say that the last instalment of the mortgage on the headquarters buildings had been cleared off. Two cups had been presented to these Companies during the year, namely, the "Countess Howe Cup," for hospital duties, and the "D'Arcy Power Cup."

After the distribution a vote of thanks was given to Mrs. Keogh on the motion of Colonel Cantlie, V.D., Honorary Colonel of the Companies, who, in the course of his remarks, said that the real founder of the Companies was the late Surgeon-General Crawford, and after him Surgeon-General Evatt. In responding to the vote of thanks, Surgeon-General Keogh said he had been told that he had too high an opinion of what the Royal Army Medical Corps (Volunteers) could do, but he knew no reason why civilians should not be as efficient, in some respects, as the men of the regular service, because they got opportunities of making themselves efficient which the Royal Army Medical Corps regulars did not get, particularly in field duties, their organisation being of a more permanent nature. In the event of war breaking out he was sure that he could confidently call upon a large number of the members of these Companies for service, and that he would utilise them, not as individuals, but as field medical units, and that he was sure they would perform their duties as well as they did during the South African War.

Captain P. J. Probyn, D.S.O., has passed the recent examination for the intermediate M.B. of London University in the subjects, Anatomy, Physiology, Pharmacology, and Organic Chemistry.

THE ALEXANDER MEMORIAL FUND.

The subject for the next competition is "Syphilis in the Army and its influence on military service; its causes, treatment, and the means which it is advisable to adopt for its prevention."

Essays must reach the President of the Committee on or before December 31, 1905.

Essays are to be legibly written or typed, superscribed with a brief motto, and

accompanied by a sealed envelope similarly superscribed, containing the name and address of the author.

No essay shall exceed in length fifty pages of ordinary printed octavo, which may be estimated as amounting to 20,000 words. This limit is exclusive of tables which may be added in the form of appendices.

The competition is limited to executive officers of the Royal Army Medical Corps on full pay, but Professors and Assistant Professors at the Royal Army Medical College are not allowed to compete while so employed.

By order of the Committee,
H. C. Thurston, *Major R.A.M.C.*,
Hon. Secretary.

THE PARKES MEMORIAL PRIZE.

The following is the subject for the next prize :—

" On the sanitary requirements of naval and military units in peace and war, with suggestions for complete schemes of sanitary organisation, suitable for both navy and army."

The prize is seventy-five guineas in money and a bronze medal, and is awarded triennially.

The competition is open to all medical officers of the Army, Navy, and Indian Services of executive rank on full pay, with the exception of the Professors and Assistant Professors of the Royal Army Medical College during their term of office. Essays to be sent to the Secretary of the "Parkes Memorial Fund," Royal Army Medical College, Examination Hall, Victoria Embankment, London, on or before December 31, 1906. Each essay to have a motto, and to be accompanied with a sealed envelope, bearing the same motto and containing the name of the competitor.

ROYAL SCHOOL FOR THE DAUGHTERS OF OFFICERS OF THE ARMY.

Election, June, 1905.

The Director-General would be glad if officers, who may have a vote or votes at their disposal in connection with the Royal School for the Daughters of Officers of the Army, would support the claims of Geraldine Eva Peard (nine years of age), daughter of the late Lieutenant-Colonel H. J. Peard, C.M.G., R.A.M.C.

Lieutenant-Colonel Peard was a distinguished officer of our Corps, and after serving throughout the South African War he died at Middleburg, Cape Colony (after only three days' illness), from malignant scarlet fever, contracted in his attendance on cases of the disease.

Officers may perhaps be able to render assistance in this case by securing the support of any friends they may have among subscribers.

Communications in this matter should be addressed to Major T. McCulloch, R.A.M.C., 68, Victoria Street, London, S.W.

Patterns of the proposed new R.A.M.C. Colours are now on view in the waiting-room at 68, Victoria Street, S.W.

All officers who have not yet seen them, and are passing through London, are requested to call there and record their votes.

ROYAL ARMY MEDICAL CORPS FUND.

The Sixteenth Meeting of the Committee.

The Sixteenth Meeting of the Committee was held at 68, Victoria Street, S.W., on Tuesday, January 17, at 4 p.m.

Present.

Surgeon-General A. Keogh, C.B., Director-General, Army Medical Service (Chairman).
Colonel H. E. R. James.
Major H. C. Thurston, C.M.G.
Captain G. St. C. Thom.

(1) The Minutes of the Fifteenth Meeting were confirmed.

(2) The quarterly account of the Aldershot Sub-Committee and the account for 1904 of the Annual Dinner Sub-Committee were considered and approved. They are appended to these Minutes, together with statements showing distribution of Relief from the Compassionate Fund, for Widows and Orphans and for General Relief.

(3) A sum of £40 was approved for the current quarter's expenses of the Aldershot Sub-Committee for General Relief.

(4) The sum of £79 was voted to the Royal Army Medical Corps Band for this quarter's expenditure. This expenditure, besides pay, repairs, music, &c., includes the purchase of the following:—

5 card pouches to complete Band	£5	5	0
1 flute	10	0	0
1 E flat clarionet	9	9	0

It was pointed out that the Band has hitherto been insufficiently supplied with instruments; instruments which were the private property of the performers have been used. This condition of things is gradually being placed on a satisfactory footing.

(5) The Annual Dinner Sub-Committee reported that during 1904 there were seventy-six officers still subscribing separately to the Dinner Fund, and that it was not known how many of these will in 1905 join the Royal Army Medical Corps Fund.

One hundred and sixty-seven officers attended the Annual Dinner on June 13 last, in addition to Mr. Vesey Holt, who was present as a guest.

The Committee agreed with the proposal of the Dinner Sub-Committee that the Annual Dinner should take place under the same arrangements as last year, on the Monday in Ascot week (June 19, 1905); it was also agreed that the cost of the Dinner to subscribers should be 12s. 6d. per head, as in the last four years.

(6) In accordance with the Report of the Dinner Sub-Committee, approved by the Royal Army Medical Corps Fund Committee on February 17, 1903, the Annual Dinner Sub-Committee is composed as follows:—

Principal Medical Officer, Home District, also representing the Royal Army Medical Corps Fund.
Three Retired Pay Officers.
Commandant of the Royal Army Medical College.
An Officer representing Aldershot and the Depôt, Royal Army Medical Corps.
An Officer representing Woolwich.
An Officer representing Netley.
The D.A.D.G. for the Corps, representing also the Royal Army Medical Corps Fund.

In consequence of Lieutenant-Colonel Wilson's retirement, Major H. C. Thurston, C.M.G., took his place on the Dinner Sub-Committee and, *ipso facto*, the duties of Honorary Secretary to that Sub-Committee.

The Dinner Sub-Committee therefore proposed that Lieutenant-Colonel Wilson should be asked to serve on this Sub-Committee as a representative of the Retired Pay Officers, vice Lieutenant-Colonel J. F. Beattie, resigned, and Lieutenant-Colonel Skinner was asked by the Committee to communicate with him, with a view to obtaining his acceptance of the post.

The Committee cordially endorsed the hearty vote of thanks accorded by the Dinner Sub-Committee to Lieutenant-Colonel E. M. Wilson for his invaluable services in the past as its Honorary Secretary.

The following acting Sub-Committee was appointed to carry out the arrangements for the Dinner for 1905:—

Colonel W. G. Don.
Colonel H. E. R. James.
Lieutenant-Colonel E. M. Wilson, C.B., C.M.G., D.S.O.
Lieutenant-Colonel M. O'D. Braddell.
Major H. C. Thurston, C.M.G.

(7) The annual accounts of the Royal Army Medical Corps Fund for the year ended December 31, 1904, were considered and approved. The accounts will be published in the February number of the Journal.

It was agreed that for the future the Fund accounts should be made up twice a year, namely, June 30 and December 31.

(8) The Director-General regretted that he had to inform the members that Lieutenant-Colonel Beattie had resigned his seat on the Committee, owing to the fact that his absence from London would prevent his regular attendance.

A vote of thanks was passed to Lieutenant-Colonel Beattie for his past services, which were especially valuable during the period of the formation of this Fund.

It was resolved that Lieutenant-Colonel Wilson should be asked to accept the vacancy created on this Committee by Lieutenant-Colonel Beattie's retirement.

(9) The Director-General notified that Surgeon-General H. Skey Muir, C.B., had written that the Committee seems to have more Retired Pay Officers upon it than the numbers of Retired Pay subscribers warrant, and that he begged to resign his seat thereon. He added that the hour of meeting did not suit him, but that he was aware that the hour was one which was the most convenient to the great majority of the members.

The Director-General stated that he had accepted Surgeon-General Muir's resignation with great regret, and proposed that Lieutenant-Colonel A. B. Cottell should be asked to accept the vacancy as representing Retired Pay Officers. The Committee elected Lieutenant-Colonel Cottell, subject to his acceptance of the post.

(10) The question having been raised as to the proportion of representatives of Retired Pay Officers serving on the Committee, the following facts were considered:—

The number of officers on the Active List subscribing is now 750.
There are 135 Retired Pay Officers subscribing.
There are also 5 officers of the Auxiliary Forces subscribing.
On the Committee there are 4 Retired Pay Officers and 9 on the Active List.
Last year there were 59 officers on Retired Pay subscribing to the Fund.

It will consequently be seen that the Retired Pay subscribers have more than doubled during the past year, and there is every reason to believe that officers who have once joined this Fund will, from a laudable motive of *esprit de corps*, continue to subscribe on their retirement from the Active List. This Committee therefore considers that it is desirable to retain the present number of Retired Pay Officers as members, and foresees that in the near future it will probably be necessary to increase this number.

(11) An officer commanding a regiment asked the Officer in Command, R.A.M.C., Netley, to vote for the admission to the Royal Soldiers' Daughters' Home, Hampstead, of two girls, daughters of a deceased non-commissioned officer of his regiment.

It is obvious that R.A.M.C. subscribers, by voting for applicants from other Corps, lessen the chances of those of their own Corps for admission to these institutions. By voting for R.A.M.C. candidates only, even though some votes may be thereby lost, the chances of admission of deserving cases of the Corps are increased.

Lieutenant-Colonel Twiss drew attention to this point at the last General Meeting.

With the object of keeping the point before R.A.M.C. officers, the Committee thinks it advisable to repeat here the following extract from Lieutenant-Colonel Twiss's remarks:—

If such officers as "are subscribers to schools would so arrange their votes as to place them all to the credit of children of the R.A.M.C., instead of, as was so often done, distributing them among the whole list of candidates, they would be more likely to benefit the class in whom they were most interested."

(12) The Honorary Secretary of the South African Graves Fund forwarded a letter from the Guild of Loyal Women of Johannesburg, pointing out that the graves of one N.C.O. and three men of the R.A.M.C., buried during the late war at Braamfontein, Johannesburg, are liable to damage during the heavy rains, which rapidly wash away the mounds. The Guild recommended that a coping stone be placed round the graves, at a cost per grave of about thirty shillings.

The Committee instructed the Honorary Secretary to forward a cheque for £6 from the Memorial Fund for this purpose.

(13) With reference to Minute 5 of the last meeting, it was noted that Corporal A.

died before any arrangement could be made for his reception into the Victoria Hospital for Consumption, Edinburgh.

(14) Mrs. Forrest suggested that the balance of the Forrest Memorial Fund be expended in putting up a tablet to the late Captain Forrest at Aden. Consequently the Chaplain of that garrison has been written to on the subject.

B. SKINNER, *Lieutenant-Colonel*,
Hon. Secretary.

January 18, 1905.

THE ROYAL ARMY MEDICAL CORPS FUND COMPASSIONATE FUNDS.

The following have received relief during the quarter ended December 31, 1904.

WIDOWS' AND ORPHANS' FUND.

Mrs. B., London. Wife of a Sergeant-Major who committed suicide. Was granted £6 to enable her to pay off her debts.

Mrs. W., Netley. Widow of a pensioner. Aged 45 years. Has two children under 12 years of age, and is in bad health. Has been granted £2 a month for six months, from October inclusive. Paid through Principal Medical Officer, Netley.

Mrs. M., Dover. Widow of a Sergeant-Major, with five children, only one now being with her, the remainder are in homes. Receives £2 monthly, which is being continued. Paid through Principal Medical Officer, Dover.

Mrs. S., London. Widow of 8974 Private, R.A.M.C. Has three children aged 2, 7, and 9 years respectively. Has been granted £1 monthly until the end of April, 1905. Paid through Principal Medical Officer, Home District.

Mrs. G., Dublin. Widow of 2737 Private, A.H.C. Aged 49 years. Has four children, the youngest being 15 and 12 years respectively. Has been granted £1 10s. monthly. Paid through Principal Medical Officer, Dublin.

Mrs. C., Chester. Widow of 9938 Private, R.A.M.C. Aged 56 years. Receives £1 5s. monthly.

Mrs. S., Netley. Widow of a pensioner. Aged 56 years. Receives £2 monthly.

Mrs. H., Chester. Widow of 15532 Corporal, R.A.M.C. Aged 44 years. Receives £1 5s. monthly.

Mrs. S., London. Widow of a pensioner. Aged 58 years. Receives £1 10s. monthly.

Mrs. W., Colchester. £1 monthly, discontinued after October, not being required.

Mrs. S., London. Widow of 60491C Staff-Sergeant. Aged 41 years. Receives £1 monthly.

Mrs. K., London. Widow of a pensioner. Aged 64 years. Receives £1 10s. monthly.

Mrs. I., Dublin. Widow of a pensioner. Aged 62 years. Receives £1 10s. monthly.

Mrs. E., Dublin. Widow of a Staff-Sergeant. Aged 42 years. Receives £2 monthly.

Mrs. S., Dublin. Widow of a Corporal, A.H.C. Aged 60 years. Receives £2 monthly.

Mrs. R., Dublin. Widow of 2512 A.H.C. Aged 45 years. Receives £2 monthly.

Child P., Cahir., Child of late 71502C Staff-Sergeant. Guardian receives £1 5s. monthly.

Mrs. C., Norwich. Widow of a Private. Aged 38 years. Receives £2 monthly.

Mrs. S., London. Widow of a Private. Aged 36 years. Receives £2 monthly.

GENERAL RELIEF FUND.

Mr. F. L., Havant. Late 10001 Private, M.S.C., received £2 monthly, which was continued from last quarter.

Mrs. B., London. Wife of 18153 Private, R.A.M.C., receives £2 monthly, which was continued from last quarter.

Mr. E. W., Failsworth, Lancs. Late 9350 Private, R.A.M.C., receives £1 10s. monthly, which was continued from last quarter.

Mrs. S., Dublin. Wife of 16159 Private, R.A.M.C., receives £2 monthly, which was continued from last quarter. Was discontinued after November on recommendation of Principal Medical Officer, Dublin, as the woman had been admitted into the workhouse infirmary.

Mr. F. P., Ash, Surrey. Late 10947 Private, R.A.M.C., receives £2 monthly, which was continued from last quarter.

Mrs. G., Portsmouth. Wife of 18286 Private, R.A.M.C. Discharged. Received £2 monthly, which was continued from last quarter. Was discontinued after October, it not being considered necessary by the officer who visited the home.

ROYAL ARMY MEDICAL CORPS COMPASSIONATE FUND—WIDOWS' AND ORPHANS' FUND.

Balance Sheet for the Quarter ended December 31, 1904.

Receipts.

Date.		£	s.	d.
Oct. 1, 1904	Balance Credit last quarter :—			
	At Bank	75	18	10
	On deposit with interest	518	12	3
Dec. 31, 1904	Interest on deposit	6	5	8
		£600	16	9

Expenditure.

Date.	From whom received.	On what Account.	£	s.	d.
Oct. 1, 1904, to Dec. 31, 1904	Various	Monthly disbursements to 17 widows and one orphan	79	5	0
Oct. 10, 1904	Major H. C. Thurston	Grant to Mrs. B. ..	6	0	0
Nov. 10, 1904	Soldiers' Daughters' Home	Annual subscription, 1903, 1904	2	2	0
Dec. 29, 1904	H. C. Smith	Stationery	0	9	0
Dec. 31, 1904	Sergeant H. Cassell ..	Clerk	0	10	0
		Postage..	0	3	4
Oct. 29, 1904	Bank	Cheque-book	0	5	0
	Balance at Bank		87	4	6
	On deposit (including interest)[1]		424	17	11
			£600	16	9

Aldershot,
January 9, 1905.

(*Signed*) G. St. C. THOM, *Captain, R.A.M.C.,*
Hon. Secretary.

[1] £100 drawn from deposit to General Account.

THE ROYAL ARMY MEDICAL CORPS COMPASSIONATE FUND—GENERAL RELIEF FUND.

BALANCE SHEET FOR THE QUARTER ENDED DECEMBER 31, 1904.

RECEIPTS.

Date.		£	s.	d.
Oct. 1, 1904	Credit Balance from last quarter	42	18	7
		£42	18	7

EXPENDITURE.

Date.	To whom paid.	On what account.	£	s.	d.
Oct. 1, 1904, to Dec. 31, 1904	Various	Disbursements to eight cases requiring monthly relief	34	3	0
Oct. 10, 1904	Major H. C. Thurston	For urgent cases ..	5	0	0
Dec. 31, 1904	Sergeant H. Cassell..	Clerk	0	10	0
		Postage	0	1	7
	Balance at Bank	.. ..	3	4	0
			£42	18	7

Aldershot,
January 9, 1905.

(*Signed*) G. ST. C. THOM, *Captain, R.A.M.C.,*
Hon. Secretary.

ROYAL ARMY MEDICAL CORPS FUND—BAND FUND BALANCE SHEET.

OCTOBER—DECEMBER, 1904.

RECEIPTS.

Date. 1904.		£	s.	d.
	By Balance	11	11	10
Oct. 22 ..	Hon. Secretary, R.A.M.C. Fund	50	0	0
,, 31 ..	President, R.A.M. College (for services of Band, August 27, October 11, 25)	15	11	3
Nov. 18 ..	President, R.A.M.C. Mess (October subscription)	3	10	0
Dec. 12 ..	President, R.A.M.C. Mess (November subscription)	7	15	0
,, 16 ..	President, R.A.M.C. Mess, Netley (for services of Band, November 25—10 per cent. to Band Fund)	9	6	0
		£97	14	1

EXPENDITURE.

Date. 1904.		£	s.	d.
Oct. 24 ..	Travelling expenses of Band to London (October 11, 25)	4	17	6
,, 31 ..	Pay of Band (October)	20	9	6
,, 31 ..	,, ,, for R.A.M. College (August 27, October 11, 25)	8	5	0
Nov. 25 ..	Band to Netley (November 25)	8	16	0
,, 30 ..	Pay of Band (November)..	19	19	2
Dec. 31 ..	,, ,, (December)	20	6	11
,, 31 ..	Messrs. Gale and Polden (Programmes) ..	0	10	0
,, 31 ..	Mr. George Arch (Music)..	2	8	3
,, 31 ..	Messrs. Hawkes and Son (Repairs, Music, &c.)	8	9	2
,, 31 ..	Cartage of Stands, &c., to Tin Hall, December 5	0	3	0
	Postage Account	0	2	11
	Balance at Bank	3	6	8
		£97	14	1

Depôt, R.A.M.C., Aldershot,
January 7, 1905.

(*Initialled*) W. H. M.

(*Signed*) H. A. HINGE, *Major*,
Hon. Sec., R.A.M.C. Band.

THE ROYAL ARMY MEDICAL CORPS FUND.

Dinner Account for 1904.

Receipts.

Date.		£	s.	d.
January 1, 1904	Balance in hand	9	12	0
	76 Subscribers at 5s.	19	0	0
	Cheques, cash, and arrears	7	17	6
	From R.A.M.C. Fund	165	12	6
		£202	2	0

Expenditure.

Date.		£	s.	d.
	Stationery, postages, &c., as per small book	4	14	6
	Tobacco, cigars, &c.	11	17	6
	Hotel Metropole	174	12	6
	Aldershot plate	1	15	0
	,, band	3	14	9
	Repayments	1	7	6
	Balance in hand	4	0	3
		£202	2	0

January 9, 1905.

Examined and verified,
(*Signed*) W. G. DON, *Lieutenant-Colonel.*

Private T. W. H., London. Reservist of the R.A.M.C., No. 11408. Married, out of employment, and in debt. Was granted £2 7s. to enable him to clear off his debts. Man has since obtained employment.

Mr. J. W. M., Bournemouth. Late 11466 Private, R.A.M.C., a discharged invalid in a convalescent home. Was granted £3 6s. to enable him to be provided with boots and clothing.

Aldershot,
January 9, 1905.

(*Signed*) G. St. C. Thom, *Captain,*
Hon. Secretary.

BIRTH.

PALMER.—On January 27, at 3, Fingal Place, Edinburgh, the wife of Captain F. J. Palmer, R.A.M.C., of a son.

MARRIAGES.

BRAY—LAFFAN.—On January 4, at St. Mary's Church, Holyhead, by the Rev. Father D'Alton, Major G. A. T. Bray, R.A.M.C., second son of the late Major-General G. F. C. Bray (96th), to Angela, daughter of Dr. Thomas Laffan and Mrs. Laffan, St. Francis Abbey, Cashel.

JAMES—COX.—January 4, in St. Mary's Church, Donnybrook, by Rev. S. A. Cox, M.A., Rector of St. Peter's, Wallingford (brother of the bride), assisted by the Rev. Canon Walsh, M.D., Major Henry D. James, R.A.M.C., son of the late Rev. H. D. James, M.A., Chaplain in India, to Elizabeth, daughter of the late S. A. Cox, of Dublin.

RUTHERFORD—JACKSON.—December 28, at St. John's Church, Wynberg, by the Rev. Mr. Rice-Thomas, assisted by the Rev. Mr. Nuttall-Smith, Captain J. C. Rutherford, R.A.M.C., son of the late Major William Rutherford, late 2nd West India Regiment, to Lilla Roberta, daughter of Captain C. H. Jackson, late 66th Regiment, Vredenhof, Wynberg, Cape Colony.

DEATHS.

DOBBIN.—On January 27, at 62, Woodbury Park Road, Tunbridge Wells, Captain Edward John Dobbin, Royal Army Medical Corps, aged 32 years. He entered the Service July 27, 1898, and was promoted Captain July 27, 1901. He served in India from February 16, 1899, to September 18, 1904, and had just been brought on the Home Establishment.

MITCHELL.—On February 4, at 17, Dick Place, Edinburgh, Lieutenant-Colonel Charles Andrew Pearson Mitchell, M.D., F.R.C.S.Edin., retired pay, late Royal Army Medical Corps, aged 45 years. He entered the Service February 5, 1881; was promoted Surgeon-Major February 5, 1893, and Lieutenant-Colonel February 5, 1901. He retired November 19, 1902. His war services are as follows: Egyptian Expedition, 1882. Actions of Tel-el-Mahuta and Mahsameh, both actions at Kassassin, battle of Tel-el-Kebir, and forced march on Cairo. Medal with clasp; bronze star. Soudan Expedition, 1884-5. Nile. Action at Kirbekan. Two clasps. Soudan, 1885-6. Frontier Field Force.

STERLING.—On January 30, at Cairo, Egypt, Captain Miles George Sterling, Royal Army Medical Corps, of pneumonia and pleurisy, aged 32 years. He served in South Africa as a Civil Surgeon, from May 19, 1900, to November 14, 1900, when he received his Commission in the Royal Army Medical Corps. He was promoted Captain three years later. His war services are: South African War, 1899-1901; Queen's Medal, with clasp, Cape Colony. At the time of his death he was seconded for service with the Egyptian Army.

WALSH.—On February 7, at Mer Vue, Booterstown, co. Dublin, Surgeon-Major-General Thomas Walsh, retired Army Medical Staff, aged 66 years.

The announcement of the death of Surgeon-Major-General T. Walsh will be received with great regret by his many friends at home and in India. His record was a long and distinguished one. He was a representative of the type of officer through whose exertions the unification system was established, for he was one of the first to recognise the advantages which it brought to the soldier, and to him the well-being of the soldier in peace and war was everything. His genial and kindly disposition, his zeal and energy, combined to procure for him the love and respect of all who served with him.

He entered the Service May 25, 1858; was promoted Surgeon-Major April 1, 1873; Brigade-Surgeon July 16, 1884; Surgeon-Colonel, October 28, 1889; and Surgeon-Major-General July 18, 1894. He was placed on retired pay May 29, 1898. His war services are as follows: Jowaki Expedition, 1877-8. Mentioned in Despatches. Medal with clasp. Afghan War, 1879-80. Operations around Jugdulluck, advance to the relief of Sherpur. Despatches, *London Gazette*, May 4, 1880. Medal with clasp. Egyptian Expedition, 1882. Actions of Tel-el-Mahuta and Kassassin (September 9), battle of Tel-el-Kebir. Medal with clasp; bronze star. He was in receipt of a Distinguished Service Reward.

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VOLUME IV. APRIL, 1905. No. 4.

Journal

of the

Royal Army Medical Corps.

CORRECTION.

Vol. iv., p. 237. In line 8, for the words "28° of frost," read "– 28° F. of frost."

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call attention to the papers by Surgeon-General Kerr-Innes, C.B., and by Brigade-Surgeon Marston in the A.M.D. Reports for 1878 and the following year, and to that by Major McCulloch in the A.M.D. Report for 1900. Those of the second class are descriptive of special epidemics in certain stations, and of these there is a large number.

Both forms contain many important observations and much valuable information. But the time has certainly arrived when we should have more detailed information regarding what one may call the natural history of this disease. The broad outlines were filled in many years ago, as can be seen by reference to the paper by Surgeon-General Kerr-Innes referred to above, and on many points our knowledge has hardly advanced from that stage.

We cannot expect to get this detail when the area under consideration is large; the local variations which have so important an influence on the prevalence of the disease and on many of its

peculiarities are lost, and we merely obtain a statement of the average result over the area in question. On the other hand, the local epidemic is largely the sport of circumstances, and is often an expression of extreme possibilities rather than of the average condition in that one station.

The more one enquires into the prevalence of enteric fever, the more one is impressed with the idea that it is only by the consideration of those cases where every detail can be reviewed that any real progress can be made. Hence the line of advance appears to be through the investigation of the prevalence of enteric fever (including simple continued fever also) in individual stations over a period of years. The object of this note is to point out in what direction further information is desirable, and to induce officers to collect the available information and supply it in the form of an article for publication in this Journal. A complete record for individual stations can be compiled without undue labour by officers interested in the subject.

The bacteriological aspect of the question is in no danger of being neglected. The chief points on which information is wanted are the following :—

I. The Influence of Climate.

Enteric fever is not, as formerly described, a "climatic disease," but there is no doubt that its prevalence, which is almost invariably influenced by season, or perhaps one should say, varies with the season, has some relation to climatic conditions. It is as important to know why enteric fever is *not* prevalent at one period of the year as to know why it *is* prevalent at another season. This may resolve itself into a question of the life history of the bacillus, or, on the other hand, of the varying influence of modes of propagation of the infection. The important elements are :—

(1) *Temperature.*—Certainly the mean monthly temperature, and probably the mean maxima and minima and the diurnal variation are important. Ground temperatures would be most valuable.

(2) *Rainfall.*—This is important, first in connection with the possibility of direct pollution of the water supply, and secondly, with the life history of the bacillus. The mean monthly amounts are important, also excessive or diminished amounts, either throughout the year, or from year to year. The information should be so recorded as to be easily comparable with the admissions.

(3) *Wind.*—The direction and force of the wind are important in connection with the possibility of infection from dust. Where it is possible to obtain a record of the occurrence of dust-storms, this

would be valuable, but in many cases one can only infer the dust movements from those of the air.

II. Susceptibility and Immunity.

(1) *The Natural Susceptibility of the Soldier.*—We have at present no measure of the degree to which a unit or an individual is susceptible. We know that a unit recently arrived in India is more susceptible than one that has been some time in the country, we can also ascertain the number of individuals attacked, but we cannot, from the ordinary statistics, discover the actual number of men who escape, as we have only the average strength. In many stations it would be possible to investigate this as follows :—

(*a*) At the beginning of the observation examine all the medical history sheets, and note all those men who have at any time suffered from enteric fever, or from a severe attack of simple continued fever, distinguishing between the two diseases.

(*b*) *Do the same with all Drafts or Transfers Joining the Battalion.*—One then has the whole divided into two classes, those who have been attacked and survive, who are therefore probably protected to some extent, and those who have no recorded attack and who are presumably unprotected. The possibility of an attack before enlistment, of course, must be considered, but the incidence rate in civil life in the United Kingdom is so small that in a large number of men it may almost be neglected, and in any case, if it could be arranged to see the men, a careful cross examination might eliminate this.

(*c*) *Note the Attacks in Each Class, Date, and if Possible, Severity.*—It would be necessary to obtain the assistance of the commanding officer, in order to make certain that all arrivals were reported, and, more important, all departures. Transfers to other battalions, men on detachment, and all casualties of like nature could then be noted and followed up, and enquiry made from the officer in charge of the hospitals at the station to which the man was transferred, so as to ensure the record being complete.

(*d*) *All Men Leaving the Battalion on Discharge should have this Fact with the Date noted against their Names.*—At the expiration of two years (or three years might be possible in some cases), one would have record of a large number of men who had been "exposed to infection" for varying periods, and the next stage would then be the classification of the records showing, for like periods of exposure, the attacks among those presumably protected and among those presumably not protected, and, in the last class, also those

who have escaped. If the records were kept up on the card system, the labour of collection and comparison would not be overwhelming. But the observation would require to be carried out with interest, and not as a routine record, otherwise there is not only the probability of error creeping in, but all special circumstances connected with the prevalence of enteric fever, either at the station or at other stations to which detachments went, should be recorded.

If observations of this nature were carried out in, say, a dozen stations we should be able to form a very good idea of (*a*) the number of men at each age who, within the period of observation have escaped altogether, and (*b*) the actual facts as to the supposed lessened susceptibility with increasing age. At present this is obscured by the fact that men who have been attacked and survive are not distinguished in each succeeding age group which they enter from those who have never been attacked at all. (*c*) This would also give an accurate record of second attacks, and (*d*) it might explain the observed lesser prevalence in the age group "under 20," than in the succeeding age group, a fact which is not observed among the civil population.

(2) *The Limitations of Acquired Immunity.*—As noted above, the present results leave it uncertain whether there is a real diminution of susceptibility with increasing age, or whether the observed result can be explained otherwise. Hence, it is important to note any unusual prevalence in the older age groups, either when there is an unusual prevalence in the younger groups, or in those rare cases where the older men seem to suffer most. Here it is important to ascertain whether this breaking down of the immunity of the older age group is associated with second attacks among the men composing it, or among the younger men, or whether it is the result of attacks among the older men, who have previously been exposed to infection but escaped.

III. Variations in Annual Prevalence.

At times a good deal of stress is laid on these variations, especially where sanitary improvements are supposed to be the cause of a diminution. It must be remembered that no comparison between two years or other periods is of value unless the enteric history of the units composing the garrison for each period is known and recorded. This is an obvious result of the observed facts as regards diminished incidence with increased age and service in an infected area, but it is too often forgotten, and should be recorded in all cases where the annual variations are important.

The usual information on sanitary conditions should, of course, be added to any report dealing with the points noted above, and essential features should be dwelt on, rather than an attempt made to complete a routine scheme of report.

As to the method of working out these results, even when ratios are used, the actual figures should invariably be given from which the ratios are calculated. All these compilations take time, and the results should be available for the use of other investigators in the same field, who may be working on different lines, but to whom the bare figures will often be most valuable. Graphical methods are usually sufficient for the demonstration of the relations between the phenomena recorded, especially when the actual figures are also given. But even where the author is not prepared to spend the time and labour for the work of computation, always a troublesome task, the actual numerical results are always worth recording, if they are accurate, as they can be worked out by others interested in the subject.

Much of what has been said above deals with matters which may seem to be only of academic importance and of no practical value. This, no doubt, would be true if our knowledge of the causation of enteric fever were as complete as is desirable, but at the present moment we appear to be still in that stage at which it is impossible to say that any information may not be of practical value; in any case it is of extreme interest to trace out variations in the process of infection and its results.

HINTS FOR BEGINNERS ON THE DEVELOPMENT, &c., OF X-RAY NEGATIVES.

By H. HENRY (late Royal Army Medical Corps).
Subordinate Employé, Surgical Department, Royal Army Medical College.

The Dark Room.

It is advisable when first using a dark room, to make certain that no sunlight is being admitted, and that the lamp is safe for use with rapid plates. For this purpose take an unexposed plate and place it in a clean dish ; then cover one half of the plate with any material impermeable to light and leave it for fifteen minutes on the table, at the same distance from the ruby lamp at which it is intended to work. Then develop in the usual way, and if any discoloration occurs on the uncovered half the light is not safe; either all the sunlight is not excluded from the room or the ruby lamp is too powerful. It is as well to remember that even light from the best ruby lamp will act to a certain extent on rapid plates, and therefore in placing them in the light-tight bags, and until after development, the less they are exposed even to this light the better the result will be. If it is remembered that the makers pack the plates in pairs film to film, and if the light-tight bags are arranged beforehand orange and black alternately, it is quite simple to load the bags in the dark (being careful that the fingers do not touch the film side) : then if the plates become fogged it will be evident that the faults are on the makers' side.

N.B.—Cigars or cigarettes should never be smoked in the dark room when working with sensitive plates.

———

Development.

Developer Formula.

No. I.

Hydroquinone	640 grains	(the density giver)
Sodium sulphite	8 ozs.	(the preservative)
Acid citric	4 drms.	
Ammonium bromide*	80 grains	(the restrainer)
Distilled or boiled water ..	80 ozs.	

* For Lumiére's plates substitute the same quantity of Potassium bromide for the Ammonium bromide, as it has less tendency to fog these plates.

No. II.

Sodium carbonate	8 ozs.	} (the accelerator)
Potassium carbonate	8 ,,	
Distilled or boiled water.. ..	80 ,,	

For normal exposures use equal parts of Nos. I. and II. sufficient to cover the plate.

The reason the above strong developer is recommended is that, having only a shadow to work upon, the object is to make as great a contrast as possible, and to get this effect it is necessary to use a strong well-restrained developer. By diluting the developer (which is not recommended) its action is, no doubt, rendered slower, but at the same time the *contrasts are reduced.* But as it is good contrast that is essential and the developer may appear to be working too fast, one or two extra grains of ammonium bromide will be found to have the desired slowing effect without materially reducing the strength.

Having mixed the developer, and having a clean dish in position, remove the plate from the light-tight bags, being careful that the fingers do not touch the film side of the plate, hold it by the sides cornerwise and gently knock the lower corner on the table to remove dust, &c. ; then lay the plate in the dish, film side uppermost, and pour the developer with one sweep over the plate; this latter point is very important, because if the solution does not cover the whole surface of the plate at the same time, it will leave patches and the result will be an unequally developed negative. An easy way to pour the developer over in one sweep is as follows: draw the dish to just over the edge of the table, tilting it towards you; lay the side of the measure which contains the solution on the edge of the dish, and with a quick steady movement draw the measure from end to end, at the same time pouring in the solution, immediately lay the dish flat and commence rocking it; this movement must be continued during the whole of the development. It is well to cover the dish for the first ten minutes and to refrain from holding the plate up to the ruby lamp for at least the same time. The answer to the question of "how long should it take to develop an X-ray negative?" is, to a considerable extent, a matter of temperature, developers being much less active in cold weather. This is easily understood if we remember that a developer at 55° F. acts three times slower than it would at 60° F. If we assume we are working at a temperature of 60° F., with the exposure of the plate about normal, then fifteen minutes or less should suffice. A very good guide is the appearance of the glass side of the plate.

Edwards' cathodal plates should be developed until the glass side is quite dark, in fact almost black, and on holding the plate to the ruby lamp and looking through from the film side it should appear very dense. With Lumiére's plates development should be continued until it has a dark grey appearance on the glass side.

It is better to err on the side of over—rather than under—density.

When development is complete, wash in water and transfer the plate to the fixing bath (hyposulphite of soda, 4 ozs. to the pint), which must be kept in subdued light and allow it to remain for about ten minutes, or until fixed. When thoroughly fixed the plate has a black appearance on both sides, all white or grey appearance having disappeared from the glass side. On removing the plate from the fixing bath it should not be taken out of the subdued light until it has been washed in several changes of water, as the hyposulphite of silver in the film is sensitive to light.

If it is desired to use the plate while wet for localisation, rinse well in water and then soak for five to ten minutes in a 1 in 25 solution of formalin; this will preserve the film from damage when placing the localisation accessories on it. If the negative is required for printing purposes after localisation, it should be well washed in running water changed several times for at least an hour; if it is required to dry the plate quickly after washing, re-soak in the formalin, as it may then be dried in a few minutes over a Bunsen burner or any other source of heat.

In hot climates, where it is difficult to keep the developing solutions at a temperature of not over 60° F., the following formula will be found extremely useful, as the film from the moment of starting development gradually becomes hardened, thereby overcoming the tendency to "frill."

Hydroquinone	160 grains
Sodium sulphite	3 ozs.
Potassium bromide	5 grains
Formalin	240 minims

Distilled or boiled water to 20 ozs.

This developer gives very dense negatives.

To prevent P.O.P. or other prints from blistering, use a 1 in 25 bath of formalin instead of the salt and alum recommended with the paper, or if it is desired to dry prints quickly use the formalin bath after the final washing, when they may be dried in front of a fire; glossy paper, if treated in this way with formalin, may be squeegeed on to clean suitable plates and, if placed near a fire, quickly dry and peel off, retaining a high gloss.

NOTE ON COX'S NEW PLATINUM CONTACT BREAKER, FOR USE WITH SPARK COILS.

By Surgeon-General W. F. STEVENSON, C.B., K.H.S.
Royal Army Medical Corps.

Messrs. H. W. Cox and Co. have lately (1904) patented a platinum interrupter which possesses certain advantages, especially from an Army transport point of view, which it may be well to notice in the Journal in the interest of officers of the Corps and of others doing X-ray work. In a way it is a spring-hammer interrupter, but it gives better results and can be used with less voltage than the ordinary patterns of the hammer mechanism. How it will compare in effectiveness with Mr. Apps' hammer interrupter I cannot at present say, but experiments are now being made to test it in this connection. The illustration on p. 442 will show how it is put together, and will enable an explanation of its working to be given.

A is the armature which is attracted towards the core on magnetisation of the latter when the current passes into the primary; it is supported on a spring at its lower end, but a spring of so light a kind that it is practically as free to move as if its lower end were a knife-edge standing in a V-shaped notch in a metal bar. The attraction of the core has, therefore, not to overcome the opposing effort of a strong spring, as happens in the ordinary hammer interrupter. It will, further, be observed that there is no heavy mass of metal at the upper end of the armature, the *vis inertiæ* of which has to be overcome before it begins to move towards the core. Both these conditions tend towards suddenness of the break; but upon the suddenness with which the break takes place depends to a large extent the output of the secondary discharge in spark coils, and upon the latter depends the amount of X-rays developed in the tube when coils are being used for this purpose.

In the ordinary spring interrupter, one of the contact points is fixed in the end of the hammer; in the new interrupter there is no connection between the armature and the metal arm (U in the illustration) holding the movable contact point. But as the armature, moving at a high rate of velocity, travels towards the core, it strikes against the other arm of the U-piece, and thus separates the contact

points and causes the interruption of the current through the primary wire.

To set the interrupter for work, with a pressure of 12 volts, the armature (A) should be pressed to the left until it comes in contact with the core; on its way then it will have engaged one arm of the U-piece and pulled the movable contact point into a fixed position; the contact screw (C) should then be turned so as to reduce the space between the two platinum points to about one-

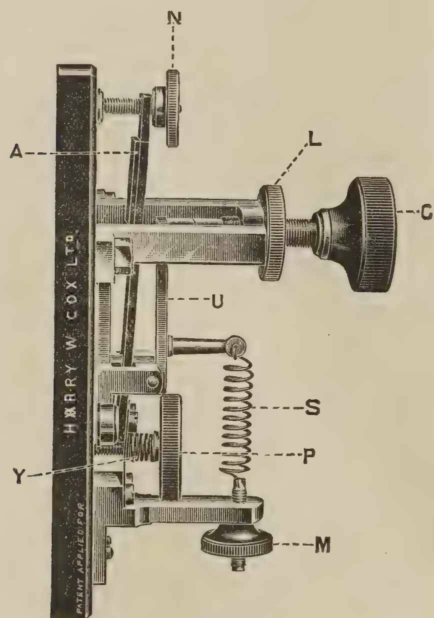

Fig. 1.

eighth of an inch, and the binding nut (L) should be screwed home to fix it in this position. As the platinum points burn away the contact screw must be occasionally used to readjust the space between them to the original one-eighth of an inch.

The amount of the current passing through the primary is regulated by the pull communicated to the spring (S) by turning the nut (M) in either direction, and this should be fixed to give a current of 6 or 7 ampères. When S is acting strongly in keeping the platinum points in contact a more powerful current is required to separate them, therefore, acting on the nut (M) affords a means of

Stereoscopic Skiagraph of the Pelvis, taken with Cox's New (1904) Platinum Breaker,
$2\frac{1}{2}$ mins. exposure, 12 volts 6 to 7 ampères.

Illustrating Paper by Surgeon-General STEVENSON.

increasing or diminishing the ampêrage of the current through the primary coil.

Upon the position of the nut (N) depends the length of swing the armature has to make to reach the core; a long swing is required when a low voltage is being used, but less when 12 volts, which give the best results with this interrupter, are being employed.

The nut (P) acts on the spiral spring (Y), which again acts on the light spring on which the armature stands, thereby permitting the armature to return to its original position more or less quickly after the magnetisation of the core has ceased at "break"; but this does not seem to have much effect on the ampèrage through the primary.

This interrupter is strongly made and unlikely to get out of order or be damaged in transport; it is rapid in action and therefore gives a steady illumination of the tube, and it gives good results as regards the negatives obtained by its use. Moreover, the heat developed in the contact points is not great, and they do not burn away rapidly; they burn evenly and do not require to be filed, thus obviating waste of the platinums. But besides these advantages, most of which might be possessed by any interrupter, it has another, from a service and transport point of view, in that by its employment a reduction in the weight of the unwieldy apparatus required for X-ray work can be made because fewer accumulators are necessary. It gives better results with 12 volts than the ordinary spring hammer does with 18, and nearly as good as Mr. Davidson's mercury break does with 36 volts (24 on the coil and 12 on the motor of the break). While, therefore, Mr. Davidson's motor break may be the best for an X-ray installation in civil practice, the one here referred to is more suitable for X-ray work in the field.

The illustration given is a stereoscopic skiagraph of the pelvis of a well-developed man, aged 26, with an exposure of two and a half minutes, using this break.

UPON THE ACTIVE IMMUNISATION OF EXPERIMENTAL ANIMALS WITH TYPHOID CELL JUICES.

By Lieutenant A. B. SMALLMAN.
Royal Army Medical Corps.
Jenner Memorial Research Student, Lister Institute of Preventive Medicine.

The active immunisation of experimental animals against the *B. typhosus* is readily accomplished, and the method is of a comparatively simple nature. If, for example, killed typhoid bacilli are injected subcutaneously, an immunity to otherwise fatal doses of the organism is established in the treated animal. The immunity thus acquired is characterised by the appearance in the blood of specific antibacterial substances. This is the essence of antityphoid inoculation as employed in the case of the human subject. The injection of suitable doses of killed typhoid bacilli evokes in the blood a condition similar to that occurring in experimental animals, and also to that occurring after recovery from a natural typhoid infection.

The vaccinating properties of dead typhoid cultures have been demonstrated notably by the work of Pfeiffer and Kolle,[1] and of Wright and Leishman.[2] The best means to be adopted for preparing and standardising the antityphoid vaccine is, however, a subject that admittedly demands further and careful study.

A conclusion, now generally accepted, is that the protective properties of the typhoid vaccine, however prepared, depend upon the bacilli contained therein. The bodies of the bacilli after injection become dissolved and their soluble immunising constituents are absorbed into the system. The immunising effect, under such conditions, is due to a utilisation of certain soluble intracellular elements of the typhoid bacillus. This being the case, it was natural that attempts should be made to obtain the immunising principles directly from the bacterial cell and to put the products to experimental tests. There are various ways in which this can be effected. A micro-organism may be dissolved with the aid of an alkali,[3] or submitted to a process of autolysis,[4] or the fresh plasma may be obtained by a mechanical trituration of the cell.[5] A discussion of the relative merits of such methods of procedure is outside the scope of the present paper. The respective methods have as their common object the extraction of immunising substances from the bacterial cell, and in this particular instance from the typhoid

bacillus. The purpose of the following inquiry was to test the feasibility of preparing a bacteria-free and fluid vaccine, and of standardising the same, *not in terms of bacilli, but in terms of the soluble immunising substances it might happen to contain.* The material was obtained with the aid of the cold-grinding method employed by Macfadyen and Rowland (*Centralblatt f. Bakteriologie*, vol. xxxiv., 1903). The typhoid organisms were grown on the surface of agar bottles at blood heat for about twenty hours. The growth was washed off with salt solution, and the bacteria spun out in a high speed centrifuge. The spun out bacteria were next reduced to the consistency of a pasty mass on the surface of a Chamberland filter, and triturated at the temperature of liquid air. The resultant mass was taken up in salt solution and centrifugalised. The cell juice was, as a rule, equivalent to a 10 per cent. solution of the intracellular constituents obtained. This material will in the following account be referred to as "typhoid cell juice," and contained from ·15 to ·2 per cent. of solid matter.

Table I.

Typhoid Cell Juice, 0·3 cc., was lethal within twenty-four hours to 200-250 grammes weight of guinea-pig on intraperitoneal injection.
Broth Culture B.T.A., 0·5 cc., was lethal in twenty-four hours for 250 grammes weight of guinea-pig on intraperitoneal injection.

Guinea-pigs' Weights, 320-400 grammes.	Dose of Typhoid Cell Juice	Test Dose	Day of Test	Alive after Twenty-four Hours	Day of Death reckoned from Inoculation of Cell Juice
1	0·4 cc.	0·8 cc.	7th	+	25th
2	0·4 ,,	0·8 ,,	,,	+	47th
3	0·2 ,,	0·8 ,,	,,	+	49th
4	0·2 ,,	0·8 ,,	,,	+	28th
5	0·1 ,,	0·8 ,,	,,	+	68th
6	0·1 ,,	0·8 ,,	,,	+	42nd
7	0·08 ,,	0·8 ,,	,,	+	49th
8	0·08 ,,	0·8 ,,	,,	+	53rd
9	0·06 ,,	0·8 ,,	,,	+	49th
10	0·06 ,,	0·8 ,,	,,	+	26th
11	0·04 ,,	0·7 ,,	,,	0	—
12	0·04 ,,	0·7 ,,	,,	+	45th
13	0·02 ,,	0·8 ,,	,,	+	Record lost
14	0·02 ,,	0·8 ,,	,,	+	36th
Controls					
1	—	0·6 ,,	—	0	—
2	—	0·5 ,,	—	0	—

The material was, to begin with, injected subcutaneously into guinea-pigs, and after varying intervals of time, the protection afforded was tested by the intraperitoneal injection of virulent typhoid bacilli, *i.e.*, of cultures which killed the control animals

within twenty-four hours. The same strain of *B. typhosus,* unless otherwise stated, was employed for the preparation of the typhoid cell juice, and for the cultures used as tests.

The details of the preliminary experiments are given in the subjoined tables, and it is to be noted that the dosage consisted of given amounts of the raw cell juice.

It will be seen that thirteen out of fourteen animals survived the test. These were kept under observation and after a time were noticed to lose condition, and eventually all died.

Post mortem.—The signs usually found were emaciation, congestion of the liver, and congestion of the lungs in this order of frequency. Cultures were made from the heart blood, the peritoneum and the spleen in most cases. From some of the animals no organisms were obtained, whilst from others the *B. typhosus,* at times in pure culture, was isolated. In this series, No. 14 gave *B. typhosus* after the longest interval, viz., twenty-nine days from the injection of the test dose, the organism being recovered from the peritoneal cavity.

TABLE II.

This experiment was a repetition of that given above.
Typhoid Cell Juice, 0·3 cc., lethal in twenty-four hours, for 250 grammes.
Broth Culture B.T.A., 0·1 cc., lethal in twenty-four hours, for 25 grammes.

Guinea Pigs' Weights	Dose of Typhoid Cell Juice	Test Dose	Day of Test	Alive after Twenty-four Hours	Day of Death, reckoned from Inoculation of Cell Juice
430 grms.	0·4 cc.	1·7 cc.	7th	+	63rd
460 ,,	0·4 ,,	1·8 ,,	,,	+	48th
440 ,,	0·2 ,,	1·7 ,,	,,	+	57th
370 ,,	0·2 ,,	1·5 ,,	,,	+	38th
320 ,,	0·1 ,,	1·3 ,,	,,	+	53rd
340 ,,	0·1 ,,	1·4 ,,	,,	+	55th
290 ,,	0·08 ,,	1·2 ,,	,,	0	—
300 ,,	0·08 ,,	1·2 ,,	,,	+	16th
290 ,,	0·06 ,,	1·2 ,,	,,	+	66th
300 ,,	0·06 ,,	1·2 ,,	,,	+	72nd
270 ,,	0·04 ,,	1·1 ,,	,,	0	—
250 ,,	0·04 ,,	1·0 ,,	,,	+	41st
250 ,,	0·02 ,,	1·0 ,,	,,	+	10th
260 ,,	0·02 ,,	1·0 ,,	,,	+	24th
Controls					
220 ,,	—	0·9 ,,	—	0	—
310 ,,	—	1·3 ,,	—	0	—

The results in this case were very similar to those of the first series—twelve of the vaccinated animals survived out of fourteen tested. The same loss of condition was observed, and all ultimately died after about the same interval of time. On cultures being

made, in some cases no organisms were recovered, in other cases the *B. typhosus* was detected—in one instance thirty-four days after the injection of the test dose, and again from the peritoneal cavity.

It having been demonstrated by the preceding experiments that the subcutaneous injection of typhoid cell juice in varying doses enabled the animals at the end of a week to withstand for a variable time (ten to seventy-two days) a dose of living organisms sufficient to kill the control animals within twenty-four hours, it appeared desirable to endeavour to find out how long this immunity lasted and in how far it was dependent on the amount of material injected. For this purpose a large series of animals were taken and received subcutaneous injections of the typhoid cell juice in doses varying from $\frac{1}{10}$ to $\frac{1}{50}$ cc.

Table III.

Typhoid Cell Juice, 0·2 cc. to 0·3 cc., lethal in twenty-four hours for 200-250 grammes. *Broth Culture B.T.A.*, lethal dose was variable.

Guinea-pigs' Weights	Dose of Typhoid Cell Juice	Test Dose	Day of Test	Alive after Twenty-four Hours	Day of Death, reckoned from inoculation of T. Cell Juice
270 grms.	0·1 cc.	0·5 cc.	14th	+	63rd
220 ,,	0·08 ,,	0·3 ,,	,,	+	30th
200 ,,	0·06 ,,	0·3 ,,	,,	+	28th
270 ,,	0·04 ,,	0·4 ,,	,,	+	49th
230 ,,	0·02 ,,	0·4 ,,	,,	0	—
210 ,,	0·02 ,,	0·4 ,,	15th	+	28th
210 ,,	0·02 ,,	0·4 ,,	,,	0	—
230 ,,	0·04 ,,	0·4 ,,	21st	+	31st
230 ,,	0·02 ,,	0·4 ,,	,,	+	24th
Controls					
180 ,,	—	0·3 ,,	14th	0	—
180 ,,	—	0·3 ,,	,,	+	—
160 ,,	—	0·2 ,,	15th	+	—
270 ,,	—	0·4 ,,	21st	0	—

Of nine animals tested on the 14th, 15th, and 21st day, seven survived. At this point it was realised that the experiment would fail to give the information desired, as it was found that out of the remaining (untested) animals, twenty-eight in number, no less than eight were dead on the 51st day after inoculation. This question of late death will be referred to below in more detail. The positive results showed so far evidence of protection at the end of three weeks.

The next Table gives the tests made upon those animals which were still alive forty-two days after inoculation.

TABLE IV.

Eight more were tested on the forty-second day.

The animal marked * was noted to be ill at the time of testing, so may perhaps be excluded.

Guinea-pigs' Weights	Dose of Typhoid Cell Juice	Test Dose	Day of Test	Alive after Twenty-four Hours	Day of Death, reckoned from Inoculation of T. Cell Juice
410 grms.	0·1 cc.	1·0 cc.	42nd	0	—
250 ,,	0·1 ,,	0·5 ,,	,,	0	—
280 ,,	0·25 ,,	0·5 ,,	,,	+	59th
*210 ,,	0·5 ,,	0·5 ,,	,,	0	—
330 ,,	0·75 ,,	1·0 ,,	,,	+	43rd
420 ,,	0·75 ,,	1·0 ,,	,,	+	Record lost.
260 ,,	1·0 ,,*	0·5 ,,	,,	+	60th
250 ,,	1·0 ,,	0·5 ,,	,,	+	45th
Controls					
420 ,,	—	1·0 ,,	—	0	—
210 ,,	—	0·5 ,,	—	0	—

In the above experiment there was also evidence of protection at the end of six weeks.

The Table that follows is of interest as showing the effect of the chronic intoxication resulting from the injection of varying doses of typhoid cell juice only.

TABLE V.

Guinea-pigs' Weights	Dose of Typhoid Cell Juice	Day of Death	Results of Cultures made
210 grms.	0·04 cc.	21st	Sterile
200 ,,	0·06 ,,	,,	,,
230 ,,	0·06 ,,	,,	,,
220 ,,	0·08 ,,	,,	B.T.A.
210 ,,	0·08 ,,	36th	Sterile
210 ,,	0·08 ,,	21st	,,
270 ,,	0·1 ,,	28th	,,
200 ,,	0·25 ,,	,,	,,
240 ,,	0·25 ,,	25th	,,
250 ,,	0·25 ,,	28th	,,
270 ,,	0·5 ,,	42nd	,,
270 ,,	0·5 ,,	21st	,,
250 ,,	0·5 ,,	,,	,,
220 ,,	0·5 ,,	,,	,,
250 ,,	0·75 ,,	28th	,,
300 ,,	0·75 ,,	31st	,,
250 ,,	1·0 ,,	28th	,,
250 ,,	1·0 ,,	21st	,,

The point brought into prominence in this experiment was that the typhoid cell juice *per se* produced a toxic effect upon the animals, which first showed itself about the 21st day, by the occurrence of

a large proportion of deaths among those remaining untested. *Post mortem* all the animals showed emaciation, some congestion of the liver, a smaller number congestion of the lungs, while in others no naked-eye signs sufficient to account for death could be seen. It is probable that those animals in Tables I. and II., which, after treatment with typhoid cell juice and testing with living organisms, died and proved sterile on culture, were suffering from the effect of the same toxic agent contained in the material. It is also possible that the onset of these effects caused the irregularity of the results in Table III., which were noticeable after the 14th day. In the course of another experiment, six guinea-pigs, which had received $\frac{1}{50}$ cc. of the material subcutaneously, died at intervals of from fourteen to thirty-seven days, and all proved sterile on culture.

That the toxic substance exists in the bodies of the bacilli is indicated by the following experiment. The same virulent strain of organism from which the cell juices in the preceding cases was prepared was cultivated for twenty-four hours on agar in Roux flasks. The growth was washed off in 100 cc. sterile normal salt solution, and then sterilised by heating at 60° C. for fifteen minutes. The resulting suspension was lethal in a dose of 0·5 cc. to a guinea-pig of 200 grammes' weight on intraperitoneal injection. This suspension was injected subcutaneously, as shown below.

Doses	0·8 cc.	0·4 cc.	0·2 cc.	0·08 cc.	0·04 cc.	0·02 cc.
Weights of guinea-pigs	220 grms. 200 ,,	260 grms. 220 ,,	210 grms. 220 ,,	230 grms. 220 ,,	240 grms. 230 ,,	200 grms. 230 ,,

The animals died with emaciation at intervals of fourteen to forty-two days after injection, and all proved sterile on culture with one exception, from which a non-typhoid organism was isolated. The sharp limitation of the interval between injection and death, both in the case of the typhoid cell juice and in that of the killed organisms, is noticeable, and the commonest time of death was at the end of three weeks, several animals succumbing on the 21st day. It has not been demonstrated that as regards toxicity any marked differences exist between killed individual strains of the *B. typhosus*.

Typhoid cell juices which had been treated with chloroform vapour and were non-lethal on intraperitoneal injection of 0·5 cc., produced a similar intoxication subcutaneously. A further observation, though not in chronological order, may be quoted here. Six guinea-pigs (200—225 grammes) were inoculated, three with

·001, and three with ·0001 cc. of the cell juice. Four were dead at the end of forty-nine days, viz., two out of each group, despite the very small dose employed. On another occasion a guinea-pig weighing 750 grammes received 0·5 cc. of a typhoid cell juice which had been passed through a Berkefeld filter. The animal likewise died with the usual signs on the 40th day. There exists therefore in the bodies and in the fluid extracts of typhoid bacilli, a substance lethal to guinea-pigs at the end of about three weeks, and it is likewise present in filtered juices.

The foregoing results have been given somewhat in detail, as they appear to be of practical significance and to raise a question of considerable importance in connection with typhoid, and possibly other allied vaccines, inasmuch as if the observed toxicity is a negligible factor in the immunising process, its abolition or reduction to a minimum would be not a loss but a gain.

In the above experiments the broad fact emerged that following the doses of cell juices or killed bacilli employed, the vaccinated animals, whilst developing a certain degree of immunity, suffered concurrently from an intoxication, and that this complication ultimately resulted in death. The protective forces of the animals were not sufficient to overcome this intoxication. The guinea-pig proved markedly susceptible, so that it was impossible to determine the duration of the vaccinating effect after a certain period of time, whilst it was a complicating factor to be eliminated, if possible, in subsequent experiments with this particular species of animal. In view of this disturbing effect occurring in doses as small as $\frac{1}{50}$ cc., the next step was to inquire whether still smaller doses might not protect the animals as efficiently, or even more so, by doing away with or lessening the intoxication.

Eighteen guinea-pigs were inoculated with doses ranging from ·06 down to ·006 cc. of typhoid cell juice. The only fresh point that emerged was that ·006 cc. had the same protective effect as the larger doses, and that after a period of eleven days. The chronic intoxication already described still supervened. It appeared possible that the lowest effective dose had not been reached and the process was carried further. The Table following gives the results.

A protective effect was demonstrable with a dose of $\frac{1}{1000}$ cc. at the end of seven days. A corroborative experiment was made to test the efficacy of $\frac{1}{1000}$ cc. of the material as a protective inoculation. The animals were tested on the 13th day after inoculation and survived two lethal doses of the *B. typhosus*. An endeavour was also made to determine on what day after an inocu-

lation the protection afforded by it was established. The experiments were few in number but they indicated that protection appears to be established about the 7th day.

TABLE VI.

Typhoid Cell Juice, lethal in dose of 0·3 cc. for 200—250 grammes in twenty-four hours. *Broth Culture B.T.A.*, virulence variable.

Guinea-pigs' Weights	Dose of Typhoid Cell Juice	Test Dose	Day of Test	Alive after Twenty-four Hours	Day of Death reckoned from inoculation of Cell Juice
220 grms.	0·01 cc.	0·5 cc.	7th	+	44th
220 ,,	0·008 ,,	0·5 ,,	,,	+	11th
210 ,,	0·006 ,,	0·5 ,,	,,	+	30th
200 ,,	0·004 ,,	0·5 ,,	,,	+	24th
200 ,,	0·002 ,,	0·5 ,,	,,	+	33rd
190 ,,	0·001 ,,	0·5 ,,	,,	+	45th
220 ,,	0·01 ,,	0·5 ,,	8th	+	29th
220 ,,	0·008 ,,	0·5 ,,	,,	+	22nd
210 ,,	0·006 ,,	0·5 ,,	,,	+	33rd
200 ,,	0·004 ,,	0·5 ,,	,,	+	16th
200 ,,	0·002 ,,	0·5 ,,	,,	+	30th
180 ,,	0·001 ,,	0·5 ,,	,,	+	26th
230 ,,	0·01 ,,	0·75 ,,	9th	0	—
210 ,,	0·008 ,,	0·5 ,,	,,	+	12th
200 ,,	0·006 ,,	0·5 ,,	,,	+	30th
200 ,,	0·004 ,,	0 75 ,,	,,	+	30th
190 ,,	0·002 ,,	0·75 ,,	,,	+	54th
180 ,,	0·001 ,,	0·5 ,,	,,	0	—
Cot rols					
200 ,,	—	0·5 ,,	7th	0	—
200 ,,	—	0·5 ,,	,,	0	—
170 ,,	—	0·5 ,,	8th	+	—
170 ,,	—	0·5 ,,	,,	0	—
120 ,,	—	0·5 ,,	9th	0	—
320 ,,	—	0·75 ,,	,,	0	—

A series of animals which had been inoculated with 0·25 cc. of the cell juice were tested on the 10th day after injection; out of five guinea-pigs tested four survived an injection of 3 to 5 lethal doses of the *B. typhosus*.

The above experiments had so far demonstrated: (1) The practicability of extracting immunising substances from the typhoid bacillus; (2) the occurrence of a chronic intoxication which acted as a disturbing factor in the immunising process.

The next series of experiments was conducted with a view to determining the presence of agglutinating and bactericidal substances in the blood of animals after injection of the typhoid cell juice. Rabbits were chiefly employed for this purpose, and the smallest dose which had proved effectual in the guinea-pig was

injected intravenously. The bactericidal power of the various sera was estimated in the manner described by Wright (*Proc. Royal Society*, vol. lxxi., 1902), usually at an interval of three to four hours after the collection of the blood. The agglutinins were determined by hanging drop preparations observed at the end of one hour, the arbitrary end point being "clumping" with loss of motility in any organisms that were lying free.

Experiment I.

A cell juice from a typhoid strain of low virulence was employed, *i.e.*, from an organism which had been cultivated in the laboratory for at least twelve months, and of which the lethal dose was 1 cc. of a broth culture. Of this sterile cell juice, $\frac{1}{1000}$ cc. (·00002 grammes), was injected intravenously in two rabbits. The serum

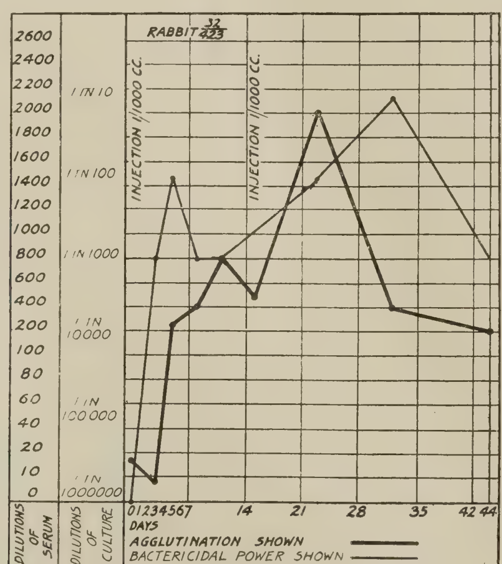

Chart I.

estimations were carried out with the same strain of bacillus. One of the rabbits died on the 7th day after inoculation from right-sided pleuro-pneumonia. In both rabbits the agglutinating value of the serum was lower on the 2nd day after inoculation than it was before treatment, while the bactericidal power was already raised. In Chart I. the agglutination and bactericidal curves of the surviving

rabbit are given after two injections of $\frac{1}{1000}$ cc., the second injection having been given fourteen days later.

Experiment II.

The cell juice employed in the first experiment was evaporated to dryness and taken up in a 1 per cent. solution of sodic carbonate in the proportion of 1 mgr. to 1 cc. of the solvent. Two rabbits received 1 cc. of this solution (·001 gram.) intravenously. The interest of this experiment lay in the ability to show that after reducing the material to a dried form, the residue may be taken up in a suitable fluid, and will on injection cause the appearance of

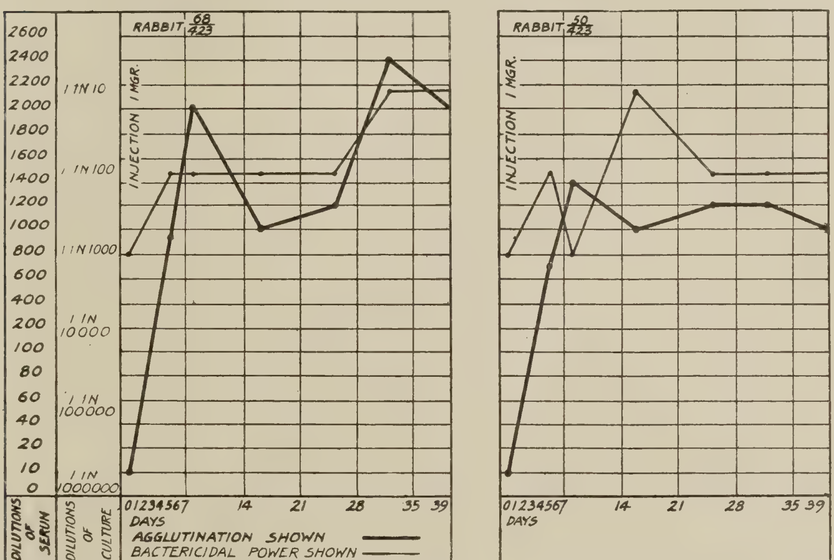

Chart II.

specific immunising substances in the blood. The results are given in Chart II. The bactericidal power of the blood prior to inoculation stood at rather a high level, but a rise was manifest four days after injection. It remained at this higher level in the case of the first rabbit for three weeks, during which time three further estimations were made. There was a further rise maintained for at least a week. The second animal shows more and greater fluctuations, but in both cases there was at the end of thirty-nine days a higher bactericidal value than existed prior to inoculation. A fall in the agglutination curve occurred in both cases from the 32nd to the 39th day.

Experiment III.

The typhoid cell juice was prepared from a strain of high virulence, and was passed through a Berkefeld filter. The filtrate was evaporated to dryness, and taken up in sodic carbonate solution in the proportion of 1 mgr. to 1 cc. of the solvent. Two rabbits received respectively 1 and 0·8 cc. intravenously. The animal which had received the larger dose died at the end of a fortnight. Chart III. shows the curves of the surviving rabbit up to the end of seventy-one days. There was in this instance also a delayed rise in the agglutinating power of the blood, but an immediate rise in the bactericidal power. It will be seen that seventy days after a single injection of the material an increased agglutinating and bactericidal power was present in the blood serum as compared with that existing in it prior to the inoculation.

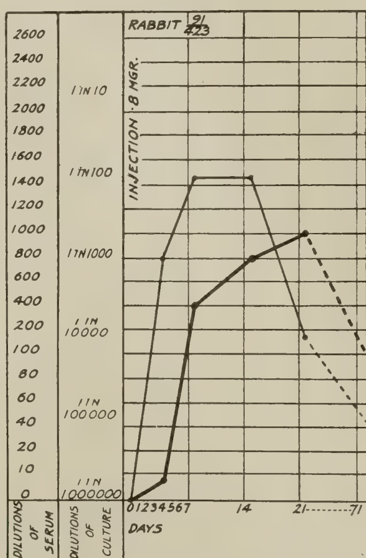

Chart III.

An experiment made on a *Rhesus* monkey gave rise to a similar result on injecting 0·5 cc. of the typhoid cell juice subcutaneously. At the end of fourteen days the bactericidal power of the monkey's blood had risen from 1 : 10,000 (negative) to 1 : 10 (positive), as tested against a virulent strain of the *B. typhosus.*

The experiments at this stage had adequately shown that the unfiltered and also the filtered typhoid cell juice gave rise to a

distinct production of agglutinating and bactericidal substances in the serum of the treated animals, and that this effect could be produced by an injection of $\frac{1}{1000}$ cc. of the cell juice, and by 1 mgr. of its dried residue.

The concluding experiments were directed to placing the results on a more exact quantitative basis, and were carried out with filtered juices containing only soluble constituents of the typhoid bacillus and free from organisms. The protective value of the inoculations was tested directly on guinea-pigs of an average weight of 300—350 grammes against multiple lethal doses of the *B. typhosus*. The same virulent strain of organism was employed for the preparation of the cell juices and for the subsequent tests.

The following Table gives the results of the subcutaneous inoculation of a typhoid cell juice before and after filtration.

Subcutaneous Inoculation of Unfiltered and Filtered Typhoid Cell Juice.

Guinea-pigs. 300-350 grms.	Dose of Juice	Test Dose of *B. typhosus*	Day of Test	Alive after Twenty-four Hours	Remarks
1	·02 cc. *unfiltered*	10 lethal doses	7th	+	—
2	·02 ,, ,,	5 ,,	,,	+	—
3	·01 ,, ,,	10 ,,	,,	0	Died before test.
4	·01 ,, ,,	5 ,,	,,	+	—
5	·005 ,, ,,	10 ,,	,,	+	—
6	·005 ,, ,,	5 ,,	,,	+	—
1	·02 ,, *filtered*	10 ,,	,,	+	—
2	·02 ,, ,,	5 ,,	,,	+	—
3	·01 ,, ,,	10 ,,	,,	+	—
4	·01 ,, ,,	5 ,,	,,	+	—
5	·005 ,, ,,	10 ,,	,,	0	—
6	·005 ,, ,,	5 ,,	,,	+	—

In the doses employed the filtered juice approximated very closely in protective power to the unfiltered juice. The only animals showing signs of local infiltration were those which had received the two highest doses of the unfiltered material.

The five series of experiments detailed below were made with filtered typhoid cell juices. The amount of solid matter present in 1 cc. of the filtered juice was in each instance estimated. This was done by drying a measured quantity of the juice *in vacuo* over sulphuric acid, and weighing the residue. It was therefore possible to gauge the amount of soluble matter contained in the respective fluid doses employed. In Series III., IV. and V., the filtered juice was diluted so that 1 cc. corresponded to 1 mgr. of solid matter. The further particulars will be found in the Tables.

SUBCUTANEOUS INOCULATION OF FILTERED TYPHOID CELL JUICE.

Series I.

1 cc. contained 3½ milligrammes solids.

Guinea-pigs 300-350 grms.	Dose of Juice	Test Dose of *B. typhosus*	Day of Test	Alive after Twenty-four Hours	Remarks
1	1 cc.	8-10 lethal doses	7th	+	—
2	1 ,,	,, ,, ,,	,,	0	—
3	0·5 ,,	,, ,, ,,	,,	+	—
4	0·5 ,,	,, ,, ,,	,,	+	—
5	0·2 ,,	,, ,, ,,	,,	+	—
6	0·2 ,,	,, ,, ,,	,,	+	—
7	0·1 ,,	,, ,, ,,	,,	0	Died before test
8	0·1 ,,	,, ,, ,,	,,	+	—
9	0·05 ,,	,, ,, ,,	,,	+	—
10	0·05 ,,	,, ,, ,,	,,	0	—

Series II.

1 cc. contained 1·2 milligrammes solids.

Guinea-pigs 300-350 grms.	Dose of Juice	Test Dose of *B. typhosus*	Day of Test	Alive after Twenty-four Hours	Remarks
1	1 cc.	8-10 lethal doses	7th	+	—
2	1 ,,	,, ,, ,,	,,	0	—
3	0·5 ,,	,, ,, ,,	,,	+	—
4	0·5 ,,	,, ,, ,,	,,	+	—
5	0·3 ,,	,, ,, ,,	,,	+	—
6	0·3 ,,	,, ,, ,,	,,	+	—
7	0·2 ,,	,, ,, ,,	,,	+	—
8	0·2 ,,	,, ,, ,,	,,	+	—
9	0·1 ,,	,, ,, ,,	,,	+	—
10	0·1 ,,	,, ,, ,,	,,	0	Died before test

Series III.

1 cc. contained 1 milligramme solids.

Guinea-pigs 300-350 grms.	Dose of Juice	Test Dose of *B. typhosus*	Day of Test	Alive after Twenty four Hours	Remarks
1	2 cc.	8-10 lethal doses	11th	+	—
2	2 ,,	,,	,,	+	—
3	1 ,,	,,	,,	+	—
4	1 ,,	,,	,,	0	Nodular spleen.
5	0·5 ,,	,,	,,	0	,,
6	0·5 ,,	,,	,,	+	—
7	0·3 ,,	,,	,,	0	Nodular spleen.
8	0·3 ,,	,,	,,	+	—
9	0·2 ,,	,,	,,	+	—
10	0·2 ,,	,,	,,	+	—
11	0·1 ,,	,,	,,	+	—
12	0·1 ,,	,,	,,	+	—

Series IV.

1 cc. contained 1 milligramme solids.

Guinea-pigs 300-350 grms.	Dose of Juice	Test Dose of *B. typhosus*	Day of Test	Alive after Twenty-four Hours	Remarks
1	2 cc.	8-10 lethal doses	8th	+	—
2	2 ,,	,,	,,	+	—
3	1 ,,	,,	,,	0	—
4	1 ,,	,,	,,	0	Nodular spleen
5	0·5 ,,	,,	,,	+	—
6	0·5 ,,	,,	,,	+	—
7	0·3 ,,	,,	,,	0	Died before test
8	0·3 ,,	,,	,,	+	—
9	0·2 ,,	,,	,,	+	—
10	0·2 ,,	,,	,,	0	Nodular spleen
11	0·1 ,,	,,	,,	+	—
12	0·1 ,,	,,	,,	+	—

Series V.

1 cc. contained 1 milligramme solids.

Guinea-pigs 300-350 grms.	Dose of Juice	Test Dose of *B. typhosus*	Day of Test	Alive after Twenty-four Hours	Remarks
1	1 cc.	8-10 lethal doses	8th	+	—
2	1 ,,	,,	,,	+	—
3	0·5 ,,	,,	,,	+	—
4	0·5 ,,	,,	,,	+	—
5	0·1 ,,	,,	,,	+	—
6	0·1 ,,	,,	,,	+	—
1	1 ,,	,,	,,	+	—
2	1 ,,	,,	,,	+	—
3	0·5 ,,	,,	,,	+	—
4	0·5 ,,	,,	,,	+	—
5	0·1 ,,	,,	,,	+	—
6	0·1 ,,	,,	,,	+	—

It is perhaps hardly necessary to comment upon these results. There was again complete absorption, and an absence of infiltration at the seat of inoculation. The filtered juices in doses corresponding to 1 mgr. of solid matter, protected the animals when tested on the 8th and 11th day against 8 to 10 lethal doses of the typhoid bacillus injected into the peritoneal cavity. A control of the number of lethal doses injected was carried out in each instance. The majority of the animals that succumbed after injection of the test doses were found to be in a diseased condition, and were consequently hypersensitive. Whilst the smallest effective dose of the filtered material in these experiments proved to be about $\frac{1}{10}$ mgr., it is possible that if still smaller amounts had been used an equivalent protective effect would have resulted.

The last series of experiments was made on the rabbit. The filtered typhoid cell juice was injected intravenously in doses that varied from about 1 to $\frac{1}{100}$ mgr. of solid matter. The protective power of the rabbits' serum was tested *in vivo* on the guinea-pig. The serum dilutions were mixed with 8 to 10 lethal doses of the *B. typhosus* and the mixture was injected into the peritoneal cavity of the guinea-pig, controls being made at the same time. The amount of serum capable of saving the life of the guinea-pig was noted and is recorded in the Table. The tests were not carried further than with $\frac{1}{200}$ cc. of the serum of the treated rabbits. The experiments, therefore, simply record the amount of soluble cell juice capable of raising the bacteriolytic titrate of the serum to $\frac{1}{200}$ cc. The possibility of still smaller doses being equally effective is not, of course, excluded. It was previously established that ·5 cc. of the normal rabbits' serum did not protect a guinea-pig against 8 to 10 lethal doses of the typhoid organism. The agglutinins were not particularly considered, greater value being attached to the actual protective power developed in the serum of the animals against an otherwise fatal infection with the *B. typhosus*.

Intravenous Injection of Typhoid Cell Juice in Rabbits (2,000 to 2,500 Grammes Weight).

Rabbit	Dose in Milligrammes of Solids	Test Dose of *B. typhosus*	Day of Test	Agglutinin titrate of Serum	Bacteriolytic titrate of Serum
1	1	8-10 lethal doses	8th	1 : 1,000 = +	·005 cc.
2	$\frac{3}{10}$	,, ,, ,,	8th	1 : 1,000 = +	·005 ,,
3	$\frac{5}{10}$	,, ,, ,,	13th	1 : 1,000 = +	·005 ,,
4	$\frac{5}{10}$	,, ,, ,,	13th	1 : 1,000 = +	·005 ,,
5	1	,, ,, ,,	8th	1 : 1,000 = +	·005 ,,
6	$\frac{1}{2}$	,, ,, ,,	8th	1 : 1,000 = +	·005 ,,
7	$\frac{1}{10}$	,, ,, ,,	8th	1 : 1,000 = +	·005 ,,
8	$\frac{1}{100}$	,, ,, ,,	8th	1 : 1,000 = +	·005 ,,

The results show that following the injection of the filtered fluids there occurred a distinct production of agglutinins and bacteriolysins in the blood of the treated animals. The serum in an amount of $\frac{1}{200}$ cc. protected guinea-pigs against 8 to 10 lethal doses of the *B. typhosus*. It will be seen that within the limits of the experiments about $\frac{1}{100}$ part of a mgr. produced an effect equivalent to that following the injection of 1 mgr. of the soluble material. This difference is a striking one, and would appear to indicate that the immunising substances, when extracted from

the typhoid bacillus in a soluble form, are demonstrably effective in very small amount. That the smallest effective dose had possibly not been reached was suggested by an experiment in which the intravenous injection of $\frac{1}{1000}$ cc. of a filtered juice resulted in a positive agglutination reaction with the rabbits' serum in a dilution of $\frac{1}{1000}$.

CONCLUSIONS.

(1) A bacteria-free and fluid typhoid vaccine can be prepared by the mechanical method employed.

(2) The fluid vaccine can be standardised in terms of the soluble immunising substances it may happen to contain.

(3) A very small amount of the soluble constituents of the typhoid organism is necessary for the active immunisation of experimental animals.

It is with much pleasure that I take this opportunity of expressing my gratitude to Dr. Allan Macfadyen, at whose suggestion I undertook the above investigation. Dr. Macfadyen has not only assisted me throughout the work with advice and criticism, but as I was obliged to leave for foreign service before its completion, has had the great kindness to complete the observations by a large number of further experiments, and has also been put to the trouble of preparing the paper in a form suitable for publication.

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SOME MEDICAL NOTES ON WAR.

I.—Our Duties in Barracks in Peace Time.

By Captain E. BLAKE KNOX.
Royal Army Medical Corps.

Probably for the same reason that the leopard cannot change his spots, nor the Ethiopian his skin, it will be found impossible to reform the past or present generation of the British Army, taken as a whole, in their sanitary arrangements, unless each rank, on promotion, is forced to pass an examination in elementary sanitation. The starting point of all sanitary reforms and all sanitary education in the Army must begin in the officer at Sandhurst, and in the recruit at his depôt. These routine sanitary measures, laid down for the life of the British officer and soldier in barracks, with their lessons and resulting habits, good, bad, or indifferent, whatever they may be, will be carried in their minds, to a greater or lesser degree on service in the field, and finally into civilian life.

If a unit has a "chief" strict as to the details of sanitation, not only of his barracks and its environments, and also of the personal hygiene of his men in peace, we may rely on it that such a unit will be "fit" and in good serviceable condition when put to the test of war. If, on the other hand, you find barrack rooms and their occupants neglected in these matters, such a condition of affairs will never tend to improve in service, but rather get worse, and this unit will invariably break down with enteric fever or other fell dirt disease.

Until such time as regimental officers take these matters up (and they must take them up), our officers in medical and sanitary charge of every unit will have to share responsibility with company officers in peace for the following duties:—

(1) The physical, sanitary and medical efficiency of their units.

(2) The training of such units in the rudiments of elementary sanitation.

(3) The training of, or supervision of, the "Pioneer section" in latrine making, construction of cooking places, and conservancy of water supplies.

(4) The instruction of the "first aid" *personnel* of the unit.

(5) Strict supervision of cook-houses, cooking vessels and cooks, the latter especially in the Tropics, where their methods ought to be gone into most fully and studied. All men of a unit should get

some sort of practice in field cooking, as on service individuals may have to cook for themselves.

Medical Inspection of Men and Barracks.—Every unit of the British Army is inspected once a week by a medical officer under the King's Regulations. The men are paraded and the medical officer walks round; some adopt one method of inspections, some another. In some cases the men are paraded on the barrack square with jackets unbuttoned, with or without shirt open and chest exposed; or again, jackets may be off and shirt sleeves rolled up, with arms and forearms bare, extended, and supinated and pronated alternately, as the inspecting officer walks down the ranks. Or again, inspection may be made in mounted corps as they finish stables; or in others while in the barrack rooms, or in India and the Tropics in the barrack verandahs. Wherever an inspection is made its thoroughness must be essential, and to ensure this, where climatic conditions, such as exposure to sun, rain, or wind may prevent it, the barrack room may be suggested as the proper place, thus ensuring comfort to the men and a more efficient and thorough inspection to the inspecting officer.

Having arranged an hour for inspection the medical officer should make a small allowance in time for each company, to avoid keeping men waiting in a state of semi-nudity, and when going round he should invariably be accompanied by a commissioned officer detailed by the officer commanding the unit; this officer should, if possible, be the adjutant; or, if this be impracticable, owing to more urgent work for him to attend to (which ought not to be always the case), the adjutant should make a point of coming occasionally, or send his understudy (assistant adjutant), and always one or two junior officers of the regiment for instruction in barrack hygiene.

It is necessary, if sanitary measures are to be efficiently adopted in the Army, to get every possible help we can from regimental officers, and, if we are to get help of value, they must see, and be made to understand, how sanitary measures are carried out; and be pointed out defects in all matters relating to barracks, food, clothing and everything pertaining to the hygiene of barracks and the health of the soldier. I have adopted this routine at each barracks I have had medical charge of, and I believe with success. Young regimental officers in some cases may perhaps take an unfavourable view of such compulsory instruction at first, but if tact is used, and the medical officer shows quietly but firmly that it is in their own interests that they should come and pick up these facts, matters which they should be thoroughly examined in later on for promo-

tion, and of which more can be taught in a five minutes' explanatory walk round than could be understood in weeks of reading, success is certain. The medical officer should not play the *rôle* of a schoolmaster, let him rather make the task interesting by asking a few questions as to the regulation amount of the various kinds of rations, scales of clothing, &c., and point out how meat is judged and the difference between old and young bones; or again, let him draw attention to defects in the physique of the soldier, such as hammer toes and varicose veins, explaining their cause and simple remedy; if this be done he will find, as I have found, that all officers will not look on such a "walk round" as a bore, but will turn up again and again, and begin to really take an interest in this branch of their profession.

Our present system of medical inspections are, I think, a mistake; they are too frequent, and such a positive nuisance to a regiment that a medical officer never sees his full charge, as it takes men from their proper regimental duties. Another result of these frequent medical inspections is also that, should a man with any contagious skin disease, or other disease, wish to stay away, he can obviously easily manage it. Men on garrison police duty, cooks, office clerks, staff clerks and the like, are never beaten up for such parades. I quite understand that such men cannot leave their posts for weekly medical inspections, but when absence occurs perpetually it makes a farce of the whole proceedings; and I may add, that such men are especially prone from their more perhaps lucrative position in life to conceal disease.

Medical inspections of units are made, not for any source of pastime or hobby of the particular medical officer making it, whom some people seem to think has nothing to do but "hunt bad smells" in or around barracks. Such visits are made in accordance with the special orders laid down in the King's Regulations, and should such inspections be omitted to be made, or neglected in their thoroughness, a medical officer could if necessary be dismissed the Service and lose his commission, in the same way as an officer commanding a regiment could be dismissed if he omitted or neglected to do his own particular duty. A medical officer inspecting barracks or men is not a faddist, he is, or at any rate he should be, thoroughly earnest; *he* is the person responsible for the health of the troops, and *he* is the person who should lose his commission if this is neglected, unless he delegates his responsibility by reporting the matter to "higher authority." As long as there is no such report higher authority takes it for granted "all is well," and trusts the

medical officer; if the latter abuse this trust by not reporting matters that are not remedied regimentally, he should be court-martialled.

Medical inspection of troops on ordinary occasions in peace time should, as I have already said, be made less frequent. The present weekly system is unsatisfactory from a medical officer's point of view, and a nuisance to every one concerned regimentally. If on such occasions the men are numbered off it will be found that half, or at least a quarter, of the regimental strength are not accounted for on parade. If questioned, the orderly-sergeant will report "Company present, Sir," and when you turn your eyes from the "thinned red line" of company representatives and ask him its full strength, and compare it with the remainder which has been numbered off, he accounts for the absentees as being on fatigue or at range firing, or some other most necessary duty. The medical officer, being conscientious and having his duty at heart, will live in hopes of seeing the absent men on another day, but if he keeps the roll in his pocket-book, of the actual number of absentees from each company he does not see each week, it will prove the fallacy of such a hope.

The important point about such absentees is, that we know full well that it is among these the very men we want most to see are to be found, as it is very probable that in their ranks some lurk who do not, for reasons best known to themselves, wish to see their medical officer. Men on extra duty pay, staff and departments are least prone of all to "go sick" as they may lose their billets; and it is I think an established fact that they are the most liable to conceal disease.

The best way out of this most apparent frustration of the present system of medical inspection, is to do away with the supposed, and I maintain impossible, inspection of a unit as a *whole* unit once a week. Even if a unit were mustered at full strength on parade, the task of proper inspection would be too much for one medical officer, who has his ordinary routine hospital work to do as well as these duties, all in the same morning. Every unit is divisible; if artillery into sections, if an infantry regiment into companies, and if a cavalry regiment into squadrons. Let these sub-units parade, let one company of an infantry regiment parade alone at as full strength as possible one week; let another company parade the next week, and so on, and let the inspection be thorough and searching. Have a roll with the names of the absentees on each parade prepared by the orderly-sergeant, and let him hand it to the

medical officer inspecting, who should keep it for reference; and let these absentees come up for inspection on the next or following days, to the same medical officer at some place appointed by him, for instance, the hospital, and let him examine and mark them off as examined on his roll. Thus a regiment or other unit can be given a clean and true bill of health, say once a month. Objection may be raised to this plan for the reason that an inspection once every two months as required by this system in a battalion of infantry at full strength, would allow for too much time to elapse between the periodic medical inspection of any single company of a regiment, if this is so, it is easily remedied and decreased by employing the same plan and parading two companies at once on the same day instead of one. But as a thorough inspection is what is necessary, my proposal is, I maintain, the best; for even should examinations be made at intervals of a month they will bear better fruit than the present system of frequent and, as I have explained, incomplete, bothersome, and useless weekly ones.

The day and hour for medical inspection should be carefully selected to suit all parties concerned; the day chosen should not, if possible, interfere with any of the men's ordinary duties or holidays, and the hour fixed should not delay meals. The same men should parade in file in their respective barrack rooms, with their jackets off, and shirts open in the front, and rolled back sufficiently wide to show as much of the chest as possible; shirt sleeves should be rolled up above the elbows. Troops should not wear closed web or merino vests under their shirts at these inspections, except they are in the habit of wearing them, when they would perhaps catch cold if they were left off; but any way they should be opened or removed in warm weather to expose the chest.

Shirts.—Shirt inspections are important, especially in the Tropics where men are inclined to discard "greybacks" for cotton ones or singlets, both of which are dangerous for the soldier under khaki drill in the sun. The cleanliness of the shirt, and hence of its wearer, can also be ascertained, as well as some idea of the upkeep and replenishment or otherwise of these articles by regimental arrangements. Men for inspection should have their coats and socks off, and their trousers rolled up above the knee so as to fully expose the calves of their legs, and leave their boots and socks on the ground for further inspection, as to fit and repair, if necessary.

Feet.—Feet inspections are most essential and should be carried out as frequently as possible; their first benefit is cleanliness. If men expect feet inspections, they will prepare for them beforehand, and no man can be made to feel more embarrassed than a soldier

parading with dirty feet before his more cleanly comrades, if a medical officer thinks fit to make him feel so. The many irregularities in feet, bunions, corns, and ingrowing toe-nails, which lead to men breaking down on the march can be looked for and pointed out to the company chiropodist for attention; the inside of the ankles can be glanced at for itch, a most common place for it to originate.

Arms, Chest and Varicose Veins.—The men having paraded in the dress just described, the medical officer should commence at the front rank man of the first file, and walk down their front, the men at the same time extending their arms and pronating and supinating their forearms alternately as he passes, in order that he may see both aspects of the arm. Boils, blind or otherwise, are often found in the mounted troops and should not escape notice. A general glance at each man's hair, face, teeth and chest, carried on to the forearms and feet, occupies but a few seconds. The chest should be scanned for *tinea versicolor*, a common skin complaint in the Army due to men wearing unwashed flannel next the skin; it is a harmless, though unsightly, disease and tends to spread rapidly. Having inspected the front rank and having perhaps noted irregularities such as want of cleanliness in regard to the teeth or other matters, the front rank should be directed to take one pace forward, and the medical officer should inspect the back of their legs for varicose veins and take a general glance at head and neck for boils; and also have a glance at their clothing as to its fit, and note things such as trousers too tightly braced up, &c. The rear rank is inspected in like manner to the front rank, after which the men can be dismissed.

Barracks.—The barrack rooms should now be inspected and such matters as general cleanliness, ventilation, washing utensils, beds and bedding, and hair and tooth brushes looked into. A medical officer should know exactly the number or scale of articles of clothing and bedding allowed to each man, and how often they should be renewed, changed, and washed; and he should ask questions of these matters of the young regimental officers who should accompany him on his rounds. If necessary, a closer medical inspection should be made to eliminate venereal and rupture cases amongst the men of a unit; such a proceeding must always be rigidly enforced prior to manœuvres or active service, as if these cases are not weeded out they will assuredly break down in a campaign and fill the hospitals.

On the relationship that should exist between a medical officer of a unit and the commanding officer of his unit, there is little to

comment on. The medical officer should act as his staff officer in all matters appertaining to the health and sanitation of the unit: he should advise on all matters tending to the health efficiency of the troops under his immediate charge, and keep a special eye on any of the weaker recruits and satisfy himself that they are not being overworked with drill, gymnasium, or fatigues, and also see that the men have proper recreation, outdoor and indoor; as such advantages keep the men from vice and liability to contract disease, especially venereal disease. The officers commanding units should be immediately informed by their medical officers of the appearance of any particular infectious disease, more especially enteric fever, among any of the men of their unit, or other person in the locality, in order that they may assist their medical officers in every possible way to stamp out the disease, and prevent its extension to their own and other units of the Army. As officers of the Royal Army Medical Corps have been specially trained in practical hygiene and bacteriology, they should be detailed at once to seek out the sources of infection, should enteric fever occur in a district, and prepare and superintend urgent and strict prophylactic measures against infection spreading to the troops. It should also be permissible to send Royal Army Medical Corps officers to places where epidemics occur out of their own station, in order that they may study, personally see, and take part in, the prophylactic measures undertaken by the local authorities. This I consider essential, for if we are to fight successfully against enteric fever in the field, it is of the greatest importance that practice should take place in time of peace, with the same means and on the same scale, if possible, as in war time; and also the more we see of enteric fever in peace time the greater will our experience be for epidemics in a campaign.

Identification.—It has been suggested that all men joining the Service should consent to have a broad arrow tattooed on the upper part of the arm, and that any man objecting to be so treated should not be accepted for service. Such refusal can only be due to some dislike in a man to future identification, which in itself ought to make him unsuitable for the Service. If every man was thus tattooed we should have a most effectual means of preventing a soldier fraudulently re-enlisting and re-entering the Army, once he has been invalided or dismissed from it. If such a measure could not be sanctioned, we might attempt a somewhat similar means of identification by the presence of Army vaccination marks, which might have some universal fixed pattern or position. As each man on enlistment has to be compulsorily vaccinated by regulations, this proposition might be carefully considered.

(To be continued.)

LOCAL ANALGESIA.

By Captain J. W. HOUGHTON.
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In view of the growing timidity in the use of general anæsthesia for operations, and the magnification of the functions of the anæsthetist, a few remarks on a method of local analgesia may be of interest. Although cocaine and the various freezing mixtures have been found useful to obviate pain in minor operations, yet their uses are restricted and utility limited. The local analgesia which has recently been brought to the notice of surgeons in England by Mr. A. E. Barker, of University College Hospital, is produced by B. eucaine, a chemical compound, occurring as a white crystalline powder of low toxicity and readily soluble in water. The injection of this in dilute solution, beneath the epidermis, causes complete analgesia of the parts infiltrated, which effect lasts about twenty minutes. To lengthen the analgesic effect of the B. eucaine and to obviate the local swelling caused by the infiltration, a solution of adrenalin chloride can be added, which actively contracts the arterioles, limiting the blood supply, and retains the B. eucaine in position, increasing the duration of its analgesic effects. The necessity for injecting a fluid isotonic with the blood should not be forgotten, or disaster will occur in otherwise promising cases.

A 1 in 500 solution of B. eucaine gives a most satisfactory analgesia, and as one seldom or never requires more than 100 cubic centimetres for one operation (usually 10 to 30 cc. suffice), powders containing B. eucaine ·2 gramme (or 3 grains), and pure sodium chloride ·8 gramme (or 12 grains) can be kept made up. One hundred cubic centimetres of distilled water (about 3½ ozs.) are boiled; a stock powder added, and we get a sterile and isotonic solution of B. eucaine, 1 in 500 normal solution. To this, when cool, should be added 1 cubic centimetre (about 18 drops) of adrenalin chloride (1 in 1,000), which has the desired effect of contracting the local vessels. A point worth mentioning about the adrenalin chloride is its spoiling by exposure to light and air, and its giving a salmon-pink colour to the solution on standing. But I have kept a solution (supplied by Parke, Davis and Co., in an amber-coloured bottle), without deterioration of its contents, for six months. There is no advantage in making up more of the solution than is immediately required, as it loses its properties and is almost inert after

twenty-four hours, while its maximum effect is reached thirty minutes after infiltration. To facilitate injection a good hypodermic syringe is essential, and one that can be boiled an advantage, as the B. eucaine before the addition of the adrenalin chloride can be boiled without hurt.

I made a small beginning to master the *technique* of the process, circumcisions and ingrowing toe-nails supplying material, and early found the necessity for isotonic solutions and the importance of infiltrating the nerves supplying the area of operation. If one can infiltrate the nerves (say at the sides of a finger), one gets complete analgesia below the point of infiltration, while there is no local swelling to obliterate anatomical landmarks. I have lately used B. eucaine and adrenalin in the following cases: (1) Removal of a cystic tumour attached to the periosteum of the scalp. (2) Removal of a fibroma attached to the posterior aspect of left trochanter, involving dissection from the bone. (3) Opening a knee-joint for removal of loose cartilage. (4) Excision of five varicose veins. (5) Excision and ligature of external piles in a case where chloroform was inadmissible. (6) Opening and draining abscess of liver. (7) Varicocele. (8) Laparotomy for perforating enteric ulcer. In all of these operations the patients expressed their freedom from all pain, except the one with the scalp tumour, which I think was insufficiently infiltrated, while a most peculiar feature of several cases was the fact that though analgesia was complete, total anæsthesia was not present, for on questioning the patients they replied that they felt no pain, but some knew when the knife was cutting them.

The knee-joint case was most instructive in demonstrating the effect of the drug, as the patient had suffered for two years from his joint "locking" on awkward occasions, and was neurotic to a degree; yet I cut down, opened the capsule, removed a piece of detached cartilage, and tapped the surface of the tibia with the point of a knife, questioning him as I worked, and all he said he could feel was a "kind of dull sensation" while I was cutting, but "no pain of any kind." The wound was healed, and the superficial stitches removed on the eighth day.

The laparotomy for enteric perforating ulcer was doubly interesting, as the patient, who had recently come from South Africa, had a very severe septicæmia. He perforated in the fifth week of the disease, with none of the classical signs of perforation, except that he vomited once. When placed on the operating table about six hours after the ulcer ruptured he was pale and collapsed.

Temp. 104° F., pulse 144, with scarcely any abdominal distension, in fact, the perforation seemed hardly to aggravate his very toxic condition of the few preceding days. After injecting the B. eucaine and adrenalin, Captain Humphry assisting, I opened the abdomen in the middle line below the umbilicus ; the patient gave expression to slight pain when I pulled on the omentum, which was adherent to the parietal peritoneum in the right iliac region, and out of the infiltration area. The perforation was soon found and closed, his lower abdomen irrigated, the abdominal walls sutured, and a gauze drain left in.

The patient only lived for fifteen hours after the operation, but I think would have died from the intensity of the fever even if he had not perforated. The points of interest were, the absence of pain during operation, the absence of shock, and the marked stimulating effect of the adrenalin.

At the conclusion of the operation, his pulse, which previously was scarcely perceptible, steadied to 106, and his temperature dropped to 101·5° F., while his condition from one of collapse improved so that he spoke intelligently. Such marked changes could scarcely be altogether due to the opening of the abdomen, showing we have in adrenalin a powerful stimulant.

A lack of material has so far limited my experience, but I see no reason why amputations and operations on herniæ could not be performed with this analgesic, the main factor in its successful use being the infiltration of all nerve trunks supplying the site of the operation—not forgetting the probability of nerve anastomosis—while the adrenalin chloride prolonging the analgesia for several hours, gives ample time to the operator, and causes an almost bloodless operation. The boiling of the solution ensures sterility, while the adrenalin supplied by Parke, Davis and Co., is itself sterile.

As to the question of choice between local and general anæsthesia, the more one sees of local analgesia, in suitable cases, the easier is the choice effected, as the patient escapes the risk and after effects of chloroform, while the operator is saved the anxiety of its administration, and economy of attendants is effected, as an anæsthetist is unnecessary.

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RESEARCHES ON MALARIA.

By Major RONALD ROSS, C.B., F.R.S., D.Sc.

Indian Medical Service (R).

(*Being the Nobel Medical Prize Lecture for the year* 1902, *delivered at Stockholm on December* 12*th.*)[1]

Preliminary.—Malarial fever, or as it is often called, paludism, or intermittent fever, is perhaps the most important of all diseases which afflict humanity. Broadly speaking, it is spread over almost the whole of the Tropics, and also extends into many countries which possess temperate climates—being found as far north as Sweden and Canada. Although, happily, it is not a very fatal disease, yet it is generally so prevalent in the countries in which it exists that the sum of the illness which it causes is immense. To take, for instance, the great country of India, with its enormous population of nearly three hundred millions, we find from the sanitary returns of the Government that the deaths from fever alone are given at 4,919,591 for the single year 1900; and average roughly about five million deaths yearly—a population nearly as large as that of Sweden and Norway. Although it is not possible to state that all this fever is malarial fever, there are reasons for thinking that most of it must be such. From the more exact returns of the Army and of the jail prisoners in India—returns attested by medical men—we find that in 1900, out of the total of 305,927 persons, no less than 102,640 were admitted into hospital for malarial fever during the year; and even this large figure is below the truth, because in India many slight cases of fever are not admitted into hospital at all. The following table, taken from the returns of the British troops in India for 1900, will enable us to compare the sickness due to malaria and to other diseases respectively:—

(1) *Average Strength of Troops* 60,653.

Diseases.	Admissions.	Deaths.	Constantly Sick.
Malarial fever	19,445	50	710
Enteric fever	970	290	141
Other fevers	1,479	2	67
Dysentery	1,561	52	108
Hepatic congestion	1,010	5	68
Hepatic abscess	156	95	15

[1] It should be understood that the lecture as given on this occasion was only an abstract of the present publication.

Diseases.	Admissions.	Deaths.	Constantly Sick.
Heat stroke	174	52	8
Cholera	107	89	2
Contagious diseases	18,049	14	1,650
Total	42,951	649	2,769

It should be noted that the death rate for malaria is here far below the truth; because, the disease being often very chronic, many of the worst cases are invalided to Europe, while in others death is often recorded as being due to intercurrent affections, such as pneumonia or dysentery, even though malaria may have been the original or principal cause of the fatal result.

Similar statistics will be found in most of the tropical countries of the world where statistics are kept at all. Even in such a temperate climate as Italy, the annual number of cases amounts, according to Celli, to something like two millions, while the number of deaths may be fifteen thousand a year. For the great continent of Africa we have, of course, no figures; but we know from the important discovery of Koch, confirmed by many German and British workers, that between fifty and a hundred *per cent.* of the negro children always remain infected—from which also we may assume that the terrible infantile mortality among negroes is largely due to this disease.

But malarial fever is important, not only because of the misery which it inflicts on mankind, but because of the serious opposition which it has always given to the march of civilisation in the Tropics. Unlike many diseases, it is essentially an endemic, a local, malady, and one which unfortunately haunts more especially the fertile, well-watered and luxuriant tracts—precisely those which are of the greatest value to man. There it strikes down, not only the indigenous barbaric population, but, with still greater certainty, the pioneers of civilisation, the planter, the trader, the missionary and the soldier. It is therefore the principal and gigantic ally of barbarism. No wild deserts, no savage races, no geographical difficulties have proved so inimical to civilisation as this disease. We may almost say that it has withheld an entire continent from humanity—the immense and fertile tracts of Africa; what we call the dark continent should be called the malarious continent; and for centuries the successive waves of civilisation, which have flooded and fertilised Asia, Europe and America, have broken themselves in vain upon its deadly shores.

(2) *The Discovery of the Parasite of Malaria.*—From the first, then, the study of this potent foe of mankind has given a great occupation to science. It is not within my province at this moment to detail the early steps by which science gradually penetrated the mystery—steps, however, which are not the less interesting to follow. Though it was well known to the ancients, the disease was not clearly differentiated from other fevers until much later. Towards the middle of the seventeenth century, however, physicians recognised that in cinchona bark we possess a drug which is a specific for a certain class of fevers, namely the intermittent fevers. As Kelsch and Kiener remark, this discovery was not only an immense therapeutical benefit, but also led to a notable pathological advance, because it enabled Morton and Torti to prescribe the exact limits of the disease curable by the medicine, namely, malarial fever; and the works of these writers, especially Torti, who without possessing thermometer or microscope accurately described the intricate course of the disease, are among the most admirable works of medical science. At the end of the seventeenth and the beginning of the eighteenth century Morton and Lancisi elaborated another important conception, that the disease is produced by some poison which enters the body from without; and the latter especially clearly understood what may be called the great law of malarial fever—that it is connected with stagnant water on the ground. The next great advance was made in the middle of last century by Meckel, Virchow, Planer, Arnstein, Frerichs, and others, who discovered that the disease is characterised by the presence in the blood and some tissues of a peculiar black granular substance, the malarial pigment or melanin; and this observation led directly to the great discovery of Laveran in 1880, that the melanin is produced within multitudes of minute amœboid parasites which live within the blood corpuscles of the patient—a discovery which not only illuminated the whole subject of malaria, but by opening a new department of parasitic pathology, has put the name of Laveran in the place of honour beside those of Pasteur, Lister and Koch.

The work of Laveran and of those who followed him affords one of the most beautiful and useful chapters in the whole book of science; and I wish that it were possible to deal with it here at length. We owe to Danilewsky, Theobald Smith and others, the discovery of similar parasites in the blood of many vertebrates, and to Laveran and Golgi the determination of several important laws concerning the whole group of these organisms. Marchiafava, Celli, Mannaberg, Metchnikoff, Canalis, Antolisei and many others added

important details; Kelsch and Bignami made minute clinical and pathological studies; Romanowsky discovered the best method of staining the parasites; Gerhardt and others produced infection by inoculating the blood of patients into healthy persons; and Richard, Councilman, Vandyke Carter, Osler, Plehn and numerous other skilled observers confirmed those results in many parts of the world. The principal conclusions reached by this mass of investigations are as follows:—

(*a*) That Laveran's parasite is the cause of malarial fever.

(*b*) That it is a sporozoon belonging to a group probably allied to the Coccidiidæ, of which other members are found in birds; and that somewhat similar but more distantly related hæmocytozoa are found in other vertebrates.

(*c*) That the organisms propagate in the blood by spore formation.

(*d*) That there are probably at least three varieties of the human parasites, which cause respectively the quartan, the tertian and the irregular (pernicious or æstivo-autumnal) fevers.

(*e*) That the paroxysm of fever commences with the release of the spores.

(*f*) That with all varieties of the parasites, there are certain forms which do not produce spores, but which, shortly after blood containing them is drawn from the host, emit certain singular motile filaments; and that the nature and functions of these forms still required further investigation.

(3) *The Problem of the Mode of Infection.*—But even after all these fine discoveries, there still remained for solution a problem of the greatest difficulty and of the greatest importance. We had discovered the pathogenetic organisms of malarial fever, and had studied them and their effects with the greatest care. This was much, but not all; it sufficed for the treatment of individual cases; but not for the prevention or extirpation of the disease on a large scale. For this we were obliged to seek a wider knowledge; the parasites occur in the human blood—but how do they arrive there? On this scientific question turned the whole prophylaxis of malaria—a subject the importance of which in connection with the future development of many of the richest portions of the world's surface I need not enlarge upon. Ignorant of the route of entry, we could rest our prophylaxis only upon an unsatisfactory empirical basis; cognisant of it, we might hope to stamp out the plague even in its most redoubtable haunts. It is my privilege in this lecture to describe particularly the steps by which this great problem has at length received its full solution.

In what manner precisely does the malarial infection reach the human blood? From early times certain cardinal facts regarding the disease have been known to us and have limited the area of investigation regarding this question. It has been recognised, first that malarial fever is essentially an *endemic* disease—that is, that it does not easily spread from man to man independently of locality, as do, for instance, small-pox or plague; secondly, that it adheres especially to warm localities where there is much stagnant water, such as marshes. Upon these facts, themselves perfectly true, numerous hypotheses have been constructed; notably the one dating from the times of Lancisi and Morton, that the disease is due to miasmata exhaled from the stagnant water—whence indeed the word *malaria* has originated; and later the allied theory of the telluric miasm, according to which the soil possesses a poisonous effluent so powerful at certain spots that it can there produce fever in man. It was even thought that when the surface of the ground is disturbed, this effluent escapes like a gas, infecting all those who live in the vicinity. These speculations afford an interesting example of the manner in which the human mind is apt to embroider fact with hypothesis. It is a fact that malarial fever is connected with stagnant water; but that the connection is due to an aerial emanation from the stagnant water was only an hypothesis which has never received experimental verification. Nevertheless it was almost universally accepted until the true explanation of the connection referred to was given in the manner which I shall presently describe.

The discovery of the pathogenetic organism by Laveran produced but little change in our ideas on this point. It was simply thought that the parasites must be capable of saprophytic life in stagnant water, and may enter the body by the inhalation of watery vapour or by infected drinking water; and, indeed, efforts to obtain experimental proof of these conceptions were quickly made, especially by Calandruccio, Marino, Agenore, and Celli, [8, 7, 4], who endeavoured to infect healthy persons by means of water brought from notoriously unhealthy sources. The experiments proved, however, entirely negative—somewhat to the surprise of those who were acquainted with them. At the same time parallel enquiries were commenced to ascertain the saprophytic stage of the parasites; and Grassi and Feletti found an amœba (*Amœba guttula*) which they thought might be the parasites in their free condition [10]. Their work recalls that of Crudeli and Klebs, who, before Laveran's discovery, claimed to have found the

cause of malaria in the form of a bacillus—which they asserted abounds in the water and soil of malarious localities, especially in the lowest stratum of the air, and gives typical intermittent fever to rabbits and other animals. All these observations are now proved to have been unsound.

(4) *First Researches in India*, 1889-94.—It is, I understand, the principal duty of those who are called to the high honour of presenting the lecture of the Nobel Medical Prize to give in it an account of their own researches; and I shall therefore begin my personal narrative at this point.[1] I had entered the medical service of the Government of India in the year 1881; but although many opportunities for studying the malarial problem had been given me, I was not specially attracted to it until the year 1889, when I first began to observe many facts at variance with the telluric hypothesis which had been instilled into me during my curriculum. I noted especially that the disease had a much more limited and localised prevalence than could be explained on any theory of aerial convection; I found that outbreaks often appeared to occur among troops merely as the result of chill or fatigue; and that in many instances the symptoms accorded ill with the classical descriptions. These observations provoked in me much dissatisfaction with accepted theories; and gradually led me to the task of reviewing the whole subject by close analysis. Unfortunately at that time it was extremely difficult to obtain in India any of the more recent literature on the subject; and even the discovery of Laveran (1880) had scarcely penetrated there as yet—much less the work of Golgi, Danilewsky, Marchiafava and Celli. I was therefore forced to rely almost solely on my own observations and thoughts; and at first

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[1] More or less brief abstracts of these investigations have already been published [54, 68], but their brevity has only had the result of permitting the genesis of many errors regarding the real nature of the task. I have therefore thought it best to give in this publication a fuller, and indeed almost autobiographical, narrative of the successive events. It is scarcely possible, except by this means, to present a true picture of the difficulties in the way of resolving this intricate problem. As so often happens in science, the most important part of the investigations really consisted of the initial failures; and I have therefore described these negative results in as much detail as is given to the discovery of the pigmented cells and of the life history of *Proteosoma* which afterwards gave the fundamental solution of the problem. It should be added that my work was minutely recorded, not so much in publications, as in a long series of letters to Manson, Laveran, and Nuttall, and that extracts from these letters are now about to be published, together with reprints of some of my papers.

fell into the mistaken conception, parallel with that of Broussais, that the disease may be due to intestinal auto-intoxication; and I published some papers supporting this view [12-16]. In 1892, however, several writers began to ventilate Laveran's work, but most unfortunately described, not the parasites of Laveran, but a number of artifacts.[1] The error was speedily detected and exposed [17, 18, 20, 21], but naturally led me (and many others in India) to doubt the whole discovery. As happened with many others, although in pursuance of these studies I had made a laborious examination of malarial blood for some years, I had failed entirely to find the true parasite at all.[2] Up to the year 1894, therefore, my work, though it gave me an invaluable training for what was to come, remained in itself quite ineffective.

(5) *Return to England*, 1894.—In 1894 I obtained furlough to England, and immediately on arrival sought the advice of Professor Kanthack. He assured me that I was mistaken in doubting the truth of Laveran's discovery, and referred me to Dr. Manson (now Sir Patrick Manson). Manson, to whom the parasite had been previously demonstrated in England, now in his turn showed it to me, and also made me acquainted with the invaluable and illuminating monographs of Mannaberg, and of Marchiafava and Bignami. I now collected my studies in the form of an essay (unpublished) in which I discussed the position of the malarial problem at the time, and which was accorded the Parkes' Memorial Prize for 1895. In November, 1894, Manson communicated to me his hypothesis, just formed by him, that the mosquito is the intermediary host of the malaria parasite, as he had proved it to be of *Filaria nocturna*. I was immediately and powerfully struck with this hypothesis, and at once determined to give it close experimental examination on my return to India. At the same time I remembered that the same hypothesis had been mentioned by Laveran, and I told Manson of the fact. It was not until 1899, after the solution of the problem, that Nuttall informed me of the earlier theories of King and Koch enunciating the same view. Consequently I have always thought it proper to state that my own work on that part of the malarial problem which flowed from the

[1] Vandyke Carter had accurately followed Laveran in Bombay in 1887; but I did not see his work until 1894.

[2] As I found subsequently, one reason for this was that I had been working principally with old æstivo-autumnal infections in which the larger and more obvious parasites (crescents) were scarce.

mosquito theory was based on the hypothesis of Manson and Laveran. But I do not wish by this admission to underrate those of King and Koch; and I shall now enter upon a short digression in order to examine all these very interesting hypotheses together.

(6) *The Theories of King, Laveran, Koch and Manson.*—As already mentioned, when the malaria parasite was discovered everyone who remembered the old telluric and miasmatic hypothesis thought that it must live a saprophytic existence in marshes, and up to 1894 Grassi's *Amœba guttula* was looked upon as being possibly the free form of the organism in water. Another interpretation of the connection between malarial fever and stagnant water had, however, been noted as early as 1883 in a remarkable paper by King [2]. King advanced the view that the malarial poison is carried from the marsh to the human being by the bites of mosquitoes which breed in marshes; and he gave with great dexterity no less than nineteen reasons in favour of this position—reasons based entirely on epidemiological considerations, such as the frequency of infection in warm, moist climates in the evening, in the lower storeys of houses, and so on. He refers to a previous enunciation of this conjecture in papers by Crawford in 1807, and Notts in 1847, now apparently lost; and he quotes Manson's filaria-mosquito work as a strong reinforcement of his views; but he is evidently ignorant of Laveran's discovery, which was then slowly fighting its way into recognition. A fuller account of his excellent paper will be found in Nuttall's history [65, 66].

Laveran's conjecture was first given briefly in 1884 [3, p. 457,] evidently independently of King. Seven years later he mooted the same idea still very briefly and without giving many reasons [11, p. 147.] The similar conjecture of Koch was not published at all; but in a letter to me he says that the mosquito theory occurred to him during his first visit to India in the winter of 1883-4, and that R. Pfeiffer mentioned the matter publicly in 1892 (*see* Koch's letter in section 23).

As already stated, Manson did not arrive at his hypothesis until near the end of 1894, when he drew attention to it (after mentioning it to me) in a short article [22]. He based it, not upon the epidemiological considerations of King, but upon a very powerful parasitological argument of his own—which was as follows. The work of Laveran, Golgi, Marchiafava, Celli and others had clearly established that the general life-cycle of the parasites within the vertebrate host consists of a process of schizogony or asexual spore formation by means of which the organisms proliferate indefinitely

in the blood. But in addition to the sporocytes existing for this purpose, all observers from the time of Laveran had observed certain large cells, which, while they were evidently mature as regards size, did not produce spores and appeared to have no function within the body. Laveran showed, however, that a few minutes after blood containing these cells was withdrawn from the circulation they underwent a singular change—that is, they gave issue to

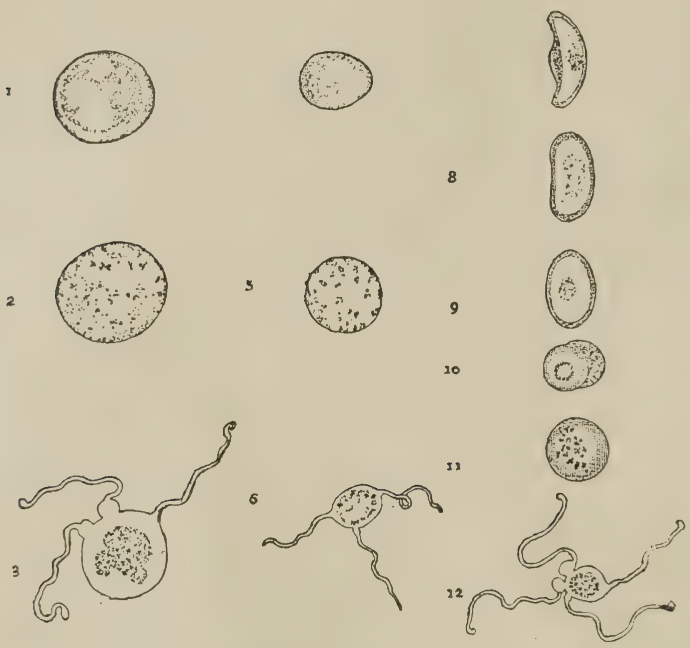

FIG. 1.—Gametocytes producing motile filaments: the tertian parasite (1–3); the quartan parasite (4–6); the æstivo-autumnal parasite (7–12). From page 644 of Manson's paper [26].

a number of long, actively motile filaments, capable of separating themselves entirely from the parent cell, and progressing independently among the blood-corpuscles. There had already been a long discussion about these forms. Grassi, followed by Bignami and many other Italians, considered them to be forms of degeneration, and held that the motile filaments were products of a kind of death agony *in vitro*. The reason given for this view was that the motile filaments contain no chromatin (which is not true); but in my opinion these observers had not considered them with sufficient

attention, or they could not have thought them to be dying bodies. On the other hand, Laveran, Danilewsky and Mannaberg, who had studied them closely, came to the opposite conclusion, that they constitute in some way the highest stage of the parasite: and Mannaberg even conjectured that they may be concerned in the passage from the intracorporeal to the extracorporeal stage of the organisms—though he did not indicate the route by which he thought the passage was made. Manson's speculation broke in at this point. He accepted Mannaberg's position, and noted also the general law that parasites must attain some means of passing (at least by their progeny) from the already-infected individual into a fresh individual; that the parasites of malaria being contained within the closed cavity of the circulation cannot escape from it except by the intervention of some external agency (*e.g.*, a suctorial insect); that the position as regards these parasites was indeed the same as that of the filaria embryos, which he had shown require the intervention of a mosquito to escape from the infected host; and that the epidemiological laws of malarial fever suggest a possible connection with the same insect. Hence it flashed upon him that the motile filaments mentioned above are really flagellate spores, which, when the parent cells are ingested by the mosquito, escape and enter the insect's tissues, developing in them into some form analogous to that of the organisms in the human blood.

Manson continued the speculation to a further point, especially in a later publication [26]. It will be remembered by those who have studied his works that in his original investigations on the development of filaria embryos in mosquitoes he had failed to ascertain that the insects live for more than a few days; he had thought that after a single meal of blood the mosquito lays her eggs on the surface of water and dies in the act of doing so. Consequently when he had traced the development of the embryos to the stage which they reach in the insect's thorax he inferred that that was the whole development, and that after the death of the host on the surface of the water the embryos escaped into the latter and finally infected man by the digestive tract.[1] And he now applied the analogy to the malaria parasites, and thought that, similarly, after the insect's death, they enter the water and infect man either by drinking-water, as he assumed for the filariæ, or by the old machinery of the aerial miasma. Thus Manson's hypothesis suggested a clue only to the departure of the parasite from the human host; it did not attempt

[1] Or possibly by piercing the integuments.

to define the route of entry, the exact mode of infection. In these points he admitted that his speculation was looser, and research has shown that he was wrong—certainly with regard to the malarial parasite and probably even with regard to filariæ. In another point, also, he was wrong—the motile filaments are not flagellate spores, as he thought they were. I remember mentioning to him at the time that they might possibly be of the nature of sperms—an idea which was suggested to me by Lewis, who conjectured that his trypanosoma might be that of nature [6, p. 638]. We shall see later what they really are. But these errors were immaterial. The fundamental part of his hypothesis was the close and powerful argument to the effect that the motile filaments and the parent cells from which they spring must be meant to infect the mosquito in some manner. This was more than a hypothesis ; it was a great and illuminating induction. It gave the required clue to further research ; and without it I am convinced the malaria problem would not have been solved at all, and we should still be engaged in a laborious and hopeless search for the parasites in water and air.

Cogent as Manson's arguments appeared to me, they were far from convincing to most other students of malaria ; and in fact no one else took the trouble to investigate the matter in spite of its immense importance to humanity. In 1896, indeed, Bignami wrote a long and dexterous article attacking the whole induction [29]. He still refused to believe that the motile filaments were anything but the result of death *in vitro*, and added that if the induction were true, malarial fever could be propagated by patients living in the presence of mosquitoes—which he refused to consider possible. At the same time he evolved a theory of his own to the effect that mosquitoes become infected with the parasites when in the larval stage in water, and then inoculate them into man during puncture. Thus while Manson thought mosquitoes carry the parasite from man to the marsh, Bignami thought that they carry it from the marsh to the man. The latter view does not appear to me a very philosophical one, since it presupposes the possibility of organisms living normally partly a saprophytic and partly a parasitic existence in the mosquito, and then being suddenly transferable on exceptionable occasions to man. Bignami's theory, however, was exactly that of King, given much more forcibly thirteen years earlier. He mentioned that he had previously attempted to infect men by gnats brought from malarious localities, but that the attempts had failed. He also referred to experiments made by Calandruccio, who had failed to observe any development of the parasites in the stomach

of mosquitoes fed on malarial blood. Lastly, he cites another most valuable analogy in favour of the mosquito theory of malaria, namely, that of the *Pyrosoma bigeminum*, a parasite of cattle allied to the parasites of malaria, and known by the brilliant researches of Theobald Smith and Kilborne to be carried by ticks [19]. Koch also had used this analogy, but I think that both Manson and myself had overlooked it somewhat unduly.[1] Curiously enough all this time it seems to have occurred to no one that the mosquito may act in both *rôles* imagined by King and Manson severally—that it may both take the parasite from the patient and also inoculate it into healthy persons. I traversed Bignami's criticisms in an article which will be referred to later (section 11).

In considering the merits of these various hypotheses we must always remember that all of them have found no little support from Manson's original discovery of the development of *Filaria bancrofti* in mosquitoes.

(7) *Nature of Proposed Investigation.*—We must now return to my own labours. As already mentioned, directly I became acquainted with Manson's induction, I determined to continue my investigation of the malaria problem entirely on this new basis.

Before my departure for India I discussed with Manson the best method of procedure.[2] We agreed that the proper course would be to select patients whose blood was rich in gametocytes (the name now given to those forms of the parasite of which some produce motile filaments), to allow mosquitoes to bite these patients, and to attempt to trace in the tissues of these insects the development of the said motile filaments (which we thought were flagellate spores). In fact, it was proposed that I should adopt exactly the procedure employed by Manson in regard to *Filaria*

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[1] The development of the *Pyrosoma* in ticks is still unknown, though the second host has long been recognised. It should be understood that the history of this organism, and of the filaria in mosquitoes, while adding great force to the mosquito *theory* of malaria, gave us no information regarding the form and position of the malaria parasites in mosquitoes, nor of the species of insect concerned. The *Pyrosoma* is not very nearly related to the malaria parasites, and the filaria not at all. I was not aware of the work of Smith and Kilborne until much later.

[2] We thought that Manson himself could not undertake the work in England, but this perhaps would not have been as difficult as we supposed. The parasites have now been cultivated in the local *Anopheles* at Hamburg and have been found in them in Holland. Work might easily have been done in this direction at home, while I was labouring in India. At all events I should have been greatly assisted by a study of British gnats.

bancrofti. It seemed necessary only to follow the motile filaments, after their escape from the gametocytes contained in the ingested blood in the mosquito's stomach, to their supposed destination within some kind of cells of the insect's tissues (*e.g.*, the stomach or blood-cells)—apparently an easy task. It was true we anticipated, on the analogy of the filaria, that not all species of mosquitoes would be amenable to the malarial infection, and we recognised that this doubt would increase the difficulties; but we hoped readily to distinguish the proper species by its particular prevalence in very malarious localities. The motile filaments being traced to their habitat in particular cells of the insect, we thought that it would be easy to observe their further development, and to watch their escape into water after the host's death. This done we should be able to identify the extra corporeal form of the parasites in water, air or dew, and to ascertain exactly the route of infection of man.

(8) *Preliminary Observations at Secunderabad,* 1895.—I reached India in 1895 and found myself appointed medical officer of a regiment of native soldiers stationed at Secunderabad and suffering much from malarial fever. A survey was immediately made of the malarial parasites existing among these men, and I found myself able to confirm for India, in almost every detail, the specialised work of the Italians and of Mannaberg.[1]

At the same time I examined the mosquitoes which abounded in the barracks and hospital. Before leaving England I had made many attempts to obtain literature on mosquitoes, especially the Indian ones, but without success, except for some brief notes in encyclopædias; and I did not even clearly recognise the identity of mosquitoes and gnats, but thought that the former constituted a special division of the Culicidæ.[2] Consequently I was forced to rely entirely on my own observations; and I noted that the various species of mosquitoes of the locality belonged apparently to two

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[1] My regiment was stationed near a small marsh and suffered badly, while another regiment situated only a mile to leeward of the same marsh escaped. My regiment suffered from the æstivo-autumnal and tertian varieties of parasite, quartan being quite absent; but in the neighbouring regiments of this great garrison quartan abounded—a fact which confirmed me in favour of the view that these varieties are distinct and not interchangeable forms. The work of Crombie and myself was the first done in India on this basis, that of Vandyke Carter (1887) being done on the basis of Laveran's works.

[2] In spite of repeated attempts to obtain such literature I remained in the same predicament until I returned to England in 1899.

different groups, separated by many traits, and called these groups for my own convenience, *brindled mosquitoes and grey mosquitoes.* It was not until 1897 that I clearly recognised a third group, which I called *spotted-winged mosquitoes* (see sections 12 and 13).

As the grey and brindled mosquitoes abounded round the infected barracks, it was naturally thought likely that they were concerned in the propagation of the disease. After some initial difficulties I caused numbers of them (especially the brindled mosquitoes) to be fed on persons with the gametocytes of æstivo-autumnal fever (crescents) in their blood. It should be noted that from the first I employed for this purpose only mosquitoes bred in captivity from the larvæ, and not insects caught at random in the houses. There were two excellent reasons for this; first, that the insects caught at random might have already fed themselves previously and have thus, for all I knew, acquired various parasites which might confuse my results; and, secondly, because it is easier to obtain the insects in numbers by collecting their larvæ and keeping them in vessels until they hatch out from the pupæ, rather than by catching each separately by hand. The mosquitoes were fed by being released from the breeding-jar into a mosquito-net, within which the patient was placed, the gorged insects being subsequently caught in bottles and dissected as required.

From the first I kept careful notes of my observations, and also recorded them in letters to Manson sent by almost every weekly mail, except when later, being very busy at Bangalore, I was obliged to reduce both notes and letters. The note-books and letters are still in my hands.

(9) *Secunderabad,* 1895. *The Motile Filaments in Mosquitoes.* —The first point requiring study was the process by which the motile filaments escape from the parent cells (gametocytes) within the stomach cavity of the mosquitoes. The process had been frequently watched *in vitro* (in slides of liquid blood prepared for the microscope), and was known to occur in from about ten to thirty minutes after the blood is drawn from the patient; but it was now necessary to follow it in the mosquito. The insects were killed from one minute to several hours after feeding, the stomach being then extracted and its contents examined in the fresh state. I was obliged to invent the *technique* for myself; and my first successful dissection was made on May 13th. Within a few weeks I made a fairly complete study of the subject and ascertained an encouraging fact. *In vitro,* doubtless owing to the unnatural conditions, only about 5 per cent. of the crescents give issue to the

motile filaments; but I now found that in the mosquito's stomach something like 60 per cent. of them do so. It was also noted that the preliminary stages of the process, namely, the swelling up and rounding of the crescents, were much more constantly seen in the blood ingested by the insect than *in vitro*. This was of importance, because it showed at least that the insect's stomach is a more favourable *locus* for the process than an ordinary specimen of blood is. I observed also that a considerable percentage of the crescents (about one-third) never produced motile filaments at all,[1] even after the lapse of several hours and within the insects; and I noticed that those which refused to emit them had a slightly different appearance to the others. At the time I thought that they were parasites which had been killed in some manner during ingestion; but when I repeated the experiments next year I saw cause to doubt this, and felt some difficulty in explaining why all the crescents did not emit filaments, as they should have done, according to Manson's hypothesis regarding their nature.

A description of these first results was written in June, but was not published until the end of the year [24].

(10) *Difficulty of the Task. New Methods Devised.*—The fact, then, was established that the gametocytes are not immediately killed in the mosquito's stomach (as might well have happened), but indeed emit their motile filaments more readily there than *in vitro*. It was necessary now to seek the destination of the latter in the insect's tissues; and here the true magnitude of the task to which I had set myself became manifest. Manson had been able to follow the migrations of the filaria embryos with comparative ease because they are large organisms readily distinguishable from the fluids or tissues which surround them; but the motile filaments are exceedingly delicate bodies, the movements of which are very difficult to follow even with the highest powers of a good microscope and in the clear spaces of an ordinary preparation of blood; but the blood in a mosquito's stomach shortly becomes a thick grumous mass in which it is impossible even to see the filaments unless they are in active movement. Moreover, even this assistance was denied me; for I speedily ascertained that within a few minutes of their escape they seemed to lose their movements. At least they constantly disappeared as if by magic; and in spite of all artifices I

[1] It was easy to distinguish those which had produced the filaments by their collapsed condition afterwards.

failed to ascertain what had become of them.[1] In fact, to trace them further, to follow the migrations of these well-nigh invisible bodies through the masses of cells of which so large an animal as a mosquito is composed, was indeed an impossible task with the means which I possessed.

Hence, though Manson then and later constantly advised me in his letters to adhere to the plan of following the motile filaments, I determined to abandon the quest and to employ other methods; and he himself failed to obtain any results with the insects which I sent to him from time to time. It was most fortunate that I came to this decision so early, because events have proved that the motile filaments migrate nowhere, and do not enter the mosquito's tissues at all.

The first method, which I now adopted and which ultimately led to success, was the following: By hypothesis, the motile filaments, after reaching the particular cells of the mosquito for which we thought they were destined, should grow in them into some unknown but larger form. It was impossible to predict what this form would be. Manson conjectured that it would very likely be some intracellular form similar to the intracorpuscular stages of the organism in the human blood—fixed perhaps in the stomach cells or blood-cells of the insect. Personally, however, while I thought this view possible, I had no full faith in it. It seemed to me that the mosquito stage of the parasite might be anything, so long as it was of a protozoal character.

The protean changes of many of the parasitic worms warned us that nature was capable of ordering any extraordinary transformations in the interest of parasites; and as no case was yet known of a protozoon capable of wandering from one species of host to another, I had no guide as to what might happen with the organisms which I was studying, and conjectured that, for all we could say, the motile filaments might develop into almost any form—amœboid, coccidiform, gregarinoid, or even infusorial, small or large. What was nearly certain, however, was that they were likely to grow in size after a few days' residence in the mosquito—to become more visible, and, if they were to pass into the water as we thought they would do, to take a definite form of resistance which ought to be easily recognisable. My new method then was to give up the

[1] It might now be possible, though still difficult, to follow them by staining them either in dehæmoglobinised blood or in section; but the Romanowsky reaction was not known to me at that time.

attempt to follow the newly escaped and almost invisible motile filaments, and to dissect the mosquitoes, not at once, but after the lapse of some days, during which time the motile filaments should by hypothesis develop into something more tangible. I proposed then to feed the mosquitoes as before on cases with crescents in the blood, to keep them alive for some days; and then search their tissues for *any* parasites which might occur in them. The parasites found, it would be easy to determine whether or not they are derived from the motile filaments, simply by ascertaining whether or not they also occur in mosquitoes of the same kind fed on healthy blood. Throughout the investigation it was of course necessary to employ only what I called in bacteriological parlance "sterile mosquitoes," that is, mosquitoes freshly hatched from the larvæ in captivity, and therefore not contaminated by previous feedings.

Such was the procedure now adopted, but the difficulties involved even in it were very great. As the situation of the sought-for parasites could not be indicated with any certainty, it became necessary to search for them through all the tissues of each insect examined, to scrutinise by a powerful microscope, one by one, all the minute cells composing the huge aggregate of which the insect consists.[1] To investigate a single insect thoroughly in this manner required at least two hours' exhausting and blinding work. Added to this difficulty, I had no clue as to the form and appearance of the object which I was seeking for; nor was I even sure that the kind of insect under examination was amenable to the infection at all. I was loooking for a thing of which I did not know the appearance, in a medium which I did not know contained it. In short, it was a mere blinding groping for some clue which I trusted fortune would give in the end. As an instance of the difficulty of such work, I may mention that neither the organisms of yellow fever, which is now known to exist in a particular kind of mosquito, nor the *Pyrosoma* of Texas cattle-fever, which is known to exist in a tick, have yet been found in these animals, though long searched for by competent observers. Nevertheless, I am confident that, hopeless as the method may appear, it was the only one capable of solving this difficult problem.

At the outset of the investigation it was necessary for me to become thoroughly acquainted with the normal histology of the mosquito—for which I had again to trust to my own observation;

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[1] Under a magnification of a thousand diameters a mosquito appears as large as a horse.—"Researches on Malaria."

in spite of all efforts no literature on the subject could be obtained by me. It was also necessary to note and study the ordinary parasites of these insects, of which I found a number during the ensuing years. Indeed, at the commencement of the work, I found one which required careful working out. It was a pseudo-navicella occurring in the malpighian tubes of the brindled mosquitoes (*Stegomyia*). After a little study it was ascertained that pseudo-navicellæ have no connection with the parasites of malaria, being the sporocysts of a species of gregarine. Next year Manson published an account of these interesting organisms taken from my letters to him [26]. I refer to them also in my publication at the end of the year [24].

The second method alluded to above was based on the following considerations. According to Manson's more advanced hypothesis, the motile filaments, after living some days in the mosquito, would probably pass from it into the water, on the surface of which we then supposed it usually died after laying its eggs. Such water, then, ought to be infective to human beings, either when ingested, or perhaps when inhaled as a vapour. It would be easy to test this speculation by experiment. I caused a number of mosquitoes, both of the brindled and grey varieties, to feed on a selected patient, and then kept them in large jars containing water at the bottom, until they died one by one. The water was then exposed to sunlight, and otherwise allowed to remain in the condition of marsh water. Different batches of fed mosquitoes were introduced into the jars from time to time so as to make sure that the water should indeed contain the parasites which by hypothesis should escape from the insects. In May, 1895, I gave draughts of this water to three natives, who volunteered themselves for the experiment. All of them declared that they had not suffered from fever for years.[1] Strangely enough, one of the men developed a mild but marked attack of fever in eleven days, the parasite being found in his blood. I was naturally much pleased with the success of the experiment, and began to hope that the mode of infection had been found ; but the failure of many subsequent attempts of the same kind forced me later to reject any definite conclusion on the point.[2]

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[1] The experiment was justifiable owing to the slight degree of illness usually produced by malarial fever in natives when properly treated.

[2] Owing to the interest of Surgeon-Major Owen, the Maharajah of Patiala had at this time offered the Government of the Punjab to employ me at his own expense to study malaria in his dominions. The Government of the Punjab, however, refused the offer.

(11) *Bangalore*, 1895-97. *Progress of Work*.—Possessing abundance of material, together with plenty of leisure, I was now progressing excellently with my researches (though without definite results) when I received my first interruption. On September 9th, 1895, I was placed on special duty by the Government of India to combat a serious outbreak of cholera in the large town of Bangalore, and also to report on the general condition of sanitation there. This duty was of great interest and value to me because it afforded me an unrivalled opportunity for examining in the closest detail the general sanitation of a tropical city—an experience which has stood me in good stead during later years. For four months, however, I was so busy with my new labours that I had little time for research. Bangalore I already knew well, having, indeed, made some of my first studies of malaria there when Staff-Surgeon of the town from 1890-93. I now easily ascertained, by the light of Laveran's great discovery, that the cases of fever which I had attributed to intestinal auto-intoxication were nothing but examples of æstivo-autumnal infection among partially immunised natives. I found also that, as at Secunderabad, my brindled and grey mosquitoes abounded all over the place. I dissected a few mosquitoes as time allowed, and when my more arduous sanitary duties began to diminish in March, 1896, I found that I could give an hour or two a day to the work. My results, however, remained constantly negative, in spite of the closest scrutiny of many mosquitoes. At the same time I continued my attempts to produce infection by water.

In March, 1896, Manson delivered the three Goulstonian Lectures at the Royal College of Physicians in London, and again put the case of his hypothesis in an admirable manner, supporting his arguments largely upon my observations of the previous year [26]. He wrote to me frequently for fed mosquitoes, which I sent to him whenever I could. He also urged me to keep on the track of the flagellated spores; advised me to try infection experiments with the insufflation of dried and powdered mosquitoes, and with the vapour of an artificial marsh in which fed mosquitoes had died. These devices did not appear as promising to me as they evidently did to him. It was scarcely likely that dead mosquitoes could do much in regard to the dissemination of malaria in nature, at least in the form of dust, owing principally to the fact that dead insects seldom escape the ants in the Tropics. All dust, moreover, is generally subject to the intense heat of the sun, which, except in the presence of water, must be very inimical to most unprotected organisms. The small amount of time at my disposal was therefore devoted to the methods already attempted.

Towards the middle of the year I had made nineteen experiments with a view to carrying infection by drinking water; and together with three more cases, I described these in a publication at the end of the year [30]. Water, in which mosquitoes fed on cases of malaria had died, or which contained large numbers of the pseudo-navicellæ of the gregarines of mosquitoes, was given to various persons by the mouth. The majority of the attempts were entirely negative; but nevertheless a slight but noticeable reaction did occur in three of the whole number of twenty-two cases. This still remains a very curious circumstance; but the facts were published exactly as they were found, without the influence of the personal equations. At the end of the paper I summarised my results and decided that the positive reactions, though interesting, were too few and too slight to warrant any definite conclusion.[1] I am now inclined to think that they may have been due to the following circumstances. The persons on whom the experiments were made were generally low-caste Indians who required a fee before drinking the water and also an assurance that they would receive more if taken ill. Now it is well recognised that many natives are constantly infected with malaria and get relapses on any extraordinary demand being made upon their systems, as by fatigue, chill, or dissipation. I have even heard it stated by medical men possessing large experience of natives, that they can often produce fever in themselves by exposure when they wish to do so. In this case, at all events, it was possible that some of the subjects spent their preliminary fees in dissipation, thus producing the supposed reaction after the experiments.

These results not being as decisive as I had expected from the first experiment of the kind made in the previous year, I began to consider whether some other route of infection was not possible or probable; and it soon grew upon me that Manson's induction was exigent only as regards the entry of the parasites into mosquitoes, and that his secondary hypothesis regarding their escape from the insects and their infection of man through drinking water was not so strong. I quickly thought of several other routes for infection—which will be examined presently; and first I considered it possible

[1] My actual words were, "While we cannot dream of stating definitely on the strength of these experiments that there is something connected with the mosquito which is capable of imparting fever, the three positive results are still curious and tend to be in favour of the truth of Manson's theory." Yet one of my Italian critics has attempted to prove, by ignoring this passage, that I pretended to have established infection by drinking water.

that the insects, previously infected from diseased persons, or possibly from other mosquitoes, might then inoculate the parasites into healthy persons during puncture, or might deposit them on the skin during haustellation. It was easy to test this view immediately by experiment, and early in August I made a small series of observations which were published in the same paper [30].

A number of mosquitoes all bred from larvæ in captivity, and of all the kinds which I could collect (many specimens of brindled and grey mosquitoes) were fed upon several patients with numerous parasites in their blood. One of these patients had all three kinds of parasites in him; and I specially employed this case, as well as many varieties of mosquitoes, in order to increase the chances of one at least of the species of mosquitoes present being appropriate for one at least of the species of parasites. After feeding, the insects were kept alive for one or two days and were then applied in considerable numbers on two occasions to Mr. Appia, Assistant-Surgeon of the Bowring Civil Hospital at Bangalore, who courageously volunteered for the experiment. Mr. Appia had suffered from malarial fever some years previously, but not since then; so that if he should be attacked by fever shortly after the experiment, it would be strong evidence, if not proof, in favour of the inoculation theory. He remained, however, absolutely free from fever. He was then bitten by five mosquitoes which had been partially fed *immediately before* on a case of crescents—on the supposition that the insects may carry the infection mechanically, as the tsetse-fly carries nagana; but the result was again negative. Lastly, two other individuals were bitten by mosquitoes fed from three to five days previously; still without effect. I judged, then, either that infection is not produced in this way, or that the proper species of mosquitoes had not been employed, or that they had not been kept for the proper period after feeding; and I proposed to return to the subject again. It should be noted that these experiments of mine were made quite independently, and before I had heard of the theories of King and Bignami—as indeed was stated in another publication of mine at the end of the year [32, p. 251].

In July, 1896, Bignami's criticism of Manson's hypothesis, referred to in section 6, appeared in Italy [29]. I heard nothing about it whatever, until I received Manson's letter of October 12th, which was accompanied by a translation of the *critique*. Bignami's paper was not a profound one, and consisted only of a copious and dexterous rendering of ideas which were new only to those who had not already fully considered the subject. His objection to Manson's

theory was based principally on Grassi's loose speculation that the motile filaments are the result of the death of the parasites *in vitro*. As this was a vital point in the chain of reasoning I now set to work to examine the subject experimentally, and was soon able to show that the escape of the filaments depends on certain proper conditions, and not at all on the death of the parasites. Thus they escape more readily when the specific gravity of the blood is altered, either by the abstraction of water by partial evaporation or, as Marshall proved, by the addition of a little water. On the other hand, they do not escape at all, even when the parent cells perish, so long as the blood is kept scrupulously unchanged. In order to prove this, I drew the blood from the finger into a small mass of vaseline placed upon the skin, and then mounted the whole for the microscope in such a manner as to prevent the blood coming even into momentary contact with the air. The result was that not a single crescent emitted motile filaments or even underwent the preliminary change of spherulisation, although it was evident they all died after a time.[1] This experiment completely disposed of the death-agony theory of the Italians. Previously to this, however, Sarcharoff had shown that, contrary to Grassi's statements, the filaments do contain chromatin; but I could not procure a copy of his work [23]. I should add that after long observation of the filaments I could never bring myself to believe that they are merely the result of the spasmodic movements of dying protoplasm; and this tale was in fact never anything but a gratuitous assumption.

These researches were published later [32, 33], and were confirmed by Manson and Rees in London [37].

The conditions required by the crescents for emitting filaments were now clearly seen to be those obtaining in the mosquito's stomach, where the blood is rapidly altered by abstraction of water; and I therefore continued my work without further reference to Bignami's objection.

His view that infection may be caused by inoculation had already been considered and experimented on by me, as just mentioned. But it should be understood that Bignami's hypothesis (which was the same as that given long previously and much more

[1] If the preparation was opened and the blood momentarily exposed to the air within some hours after abstraction from the patient, the crescents could be seen at once to resume their functions. But if this experiment was delayed about twenty-four hours, the crescents no longer reacted, and indeed showed clear evidence of death by their vacuolisation and other structural changes.

strongly by King) was very different from mine. King and Bignami thought that mosquitoes bring the poison from marshes to man; this speculation had not occurred to me until I read Bignami's paper in October, and then it did not appeal to me at all, because it was self-evident that the connection between malaria and marshes could be sufficiently explained by the fact that mosquitoes breed in stagnant water. My speculation was that mosquitoes become infected from men (according to Manson's induction) and possibly also from other mosquitoes, and then communicate the parasites to healthy persons—perhaps by inoculation. It will be seen which view is right; but in consequence of my negative experiments, the inoculation theory was not much favoured by me until I made my researches in the Sigur Ghat (Section 12).

My duties at Bangalore continued for a year and a half. At first placed upon special duty to report on the sanitation of the town (80,000 inhabitants), I was afterwards appointed officiating Residency Surgeon there and was required to reorganise the whole of the sanitary arrangements, to create a health department, to participate in a committee designated to reconstruct the municipal regulations, and to contend against several outbreaks of cholera. Consequently I did not possess as much time as at Secunderabad for my researches on malaria, but nevertheless, in addition to the experiments last referred to, I was able to dissect many hundreds of mosquitoes in pursuance of my principal plan of campaign. Several agents were employed to collect the larvæ of as many kinds of mosquitoes as possible, especially from several spots whence most of the cases of fever came; and these insects, belonging to many species of the brindled and grey groups of mosquitoes,[1] were all tested by direct feeding on cases of malaria, especially æstivo-autumnal. But though each insect was examined with the utmost care, almost every cell being scrupulously searched for parasites, the results still remained entirely negative.

Towards the end of my stay in Bangalore, as failure followed failure, I was naturally forced to reconsider the whole basis of my work. But no; the most critical examination of Manson's induction failed to exhibit any flaw in the fundamental reasoning. The gametocytes, and the process by which the motile filaments escape from them after the blood is drawn from the patient, could only be meant for infection of the mosquito. There was no other explana-

[1] Not once as yet had I come across the dappled-winged mosquitoes; though, be it noted, many of my larvæ were collected from ditches and the edges of ponds.

tion. Nature does not create these complex phenomena for nothing; and the theory must be—was—sound. What, then, was the cause of my repeated failures? Was it possible that the kinds of mosquitoes which I had tested hitherto—very many kinds—were all of the wrong species?

The reasons for and against this view were as follows: In all the districts and towns of India in which I had served or stayed during fifteen years—Madras, Bangalore, Moulmein, the Andamans, Secunderabad, Upper Burma, Bombay, Poona, Calcutta, Karachi, Quetta, the Nilgherry Hills, malaria was undoubtedly present, especially among the natives; and in all of them without exception I remember to have noticed mosquitoes belonging to both the grey and the brindled classes. This naturally suggested a connection between the disease and the insects; but, on the other hand, were not the latter perhaps too common? So far as I could ascertain, the disease was generally limited to certain spots and localities (by no means always near marshes); whereas the insects were everywhere, and were indeed often commonest at points where malaria was rare, as in the houses of Europeans. After all, may not the true malaria-bearing variety, or varieties, have been overlooked by me? Possibly they were comparatively rare species, or species occurring only at a certain season—a hypothesis favoured by the well-known fact of the seasonal variation of malaria. Now, as I was fully aware at the time, malarial fever is a relapsing disease, in which attacks continue to occur for years after infection; so that it does not follow by any means that the infective variety of mosquito must always be present in a locality, even though numerous cases of malarial fever are present. And it was to be specially noted that most of the cases occurring in Bangalore were probably only cases of relapse.

These arguments were not strong enough to be conclusive on either side of the question. I had done quite right in spending so much time over the grey and brindled mosquitoes; there was enough *prima facie* evidence against them to demand a full enquiry. But before spending more time over them it was now advisable to see whether further light could be obtained by epidemiological investigation. The towns in which I had worked hitherto could scarcely be considered more than moderately malarious; I now proposed to visit an intensely malarious spot, at the height, too, of the malarious season, in order to ascertain what kind of mosquitoes prevailed there at the time, and reasonably hoped that this kind would prove to be the guilty species.

Being a servant of Government I could not of course go where I

pleased without leave, and I therefore first attempted to interest Government in my work. Owing to my representations the United Planters' Association of Southern India took up the matter; and the Honourable Mr. Bliss, Member of Council of the Madras Government, and also Surgeon-General Sibthorpe, head of the Madras Medical Service, were kind enough to give their warm assistance—for which I shall always be much indebted. The result was that the Government of Madras made a proposal to the Government of India that I should now be placed on special duty to investigate malaria. Most unfortunately, however, in addition to the plague, the Afridi war broke out just about that time, and owing to the paucity of medical officers the Government of India was obliged to reject the proposal—May, 1896. But in the meantime I had determined to begin the enquiry at once at my own expense during two months' leave which was due to me; and accordingly, on the completion of my duty in Bangalore, I went to the Nilgherry Hills for the purpose of studying the point referred to in some of the intensely malarious plantations at the foot of these mountains.

(*To be continued.*)

ZITTMAN'S TREATMENT FOR SYPHILIS.

By Lieutenant-Colonel G. H. SYLVESTER
and Captain C. B. CRISP.
Royal Army Medical Corps.

During the past five months we have tried Zittman's treatment, which was recommended in the Official Copy of "The Treatment of Venereal Disease and Scabies in the Army" (First Report, 1904), and in a special number of the *Practitioner*, devoted to Syphilis, recently published.

The results on the whole have been most satisfactory, the effect is often most marked, and the way a patient who has been going from bad to worse will suddenly improve, both locally and generally, is astonishing.

The treatment causes diaphoresis and diuresis, and also slight diarrhœa; it evidently eliminates the poison from the system by this means, and possibly an examination of the excretions might furnish some information as to its nature. I hope to get this done.

Number of cases treated, 23. Of these cases 18 went through the treatment once; 4, twice; 1, three times.

Tabulated results: In 13 cases a great deal of good resulted; in 4 a good deal of good resulted; in 2 there was some improvement only; in 1 there was very slight improvement only; in 3 there was practically no result.

(1) Taking first the 13 cases in which a great deal of good resulted: (*a*) In one of these the man was in an extremely bad state, weighing only 116 lbs., listless, eating nothing, nose, palate and face rapidly sloughing away, necrosis of bones of palate occurring. During the treatment (which he stood well) his weight went down to 97 lbs., but the destruction of tissue was rapidly checked, and within two months afterwards his weight has gone up to 145 lbs.; he eats well, and is quite lively. (*b*) In two other cases, where destruction of tissue was taking place in the face, the destruction of tissue was rapidly checked, and the gain in weight within a short time was 14 lbs. and 21 lbs. respectively. (*c*) In another case the man's whole back was covered with a rash of the nature of a psoriasis, and his face was also, but to a less extent, involved. The rash entirely disappeared under the treatment. (*d*) In most of the cases there was extensive ulceration, which rapidly dried up under treatment. Broken down

gummata dried up and formed hard scars. (*e*) In one case, of a man who was bedridden with pains in all his joints, he was able to be about and walk considerable distances afterwards.

In *all these cases* there was *considerable gain* in weight *after* the treatment, in several cases 20 to 25 lbs. being rapidly put on, and the general condition was greatly improved.

(2) In the 4 cases in which a good deal of good resulted, ulcers on various parts of the body were caused to become smaller and often to dry up, and syphilitic pains in the joints generally became rather less severe.

(3) In the 3 cases in which practically no good resulted the patients were men with severe pains in the joints and with ulceration in 2 of the cases. Why there was no good result seems hard to explain, as these cases seemed quite similar to others who did well.

(4) Taken as a whole the Zittman treatment seems to have much more effect upon skin and connective tissue lesions, and in improving the general health and causing increase in weight, than it has upon cases suffering from syphilitic pains in the joints

MALIGNANT SYPHILIS.

By Captain H. C. FRENCH.
Royal Army Medical Corps.

Referred to, but rarely discussed, is a type of syphilis seen by the Army surgeon of the present day, and known as "malignant or galloping syphilis," the "syphilis maligne" of French writers. A better name could not be devised for a disease whose effects are of the gravest, whose course is most rapid, where the prognosis is uncertain, and where death is not uncommon. The term "syphilis grave," according to Dr. George Ogilvie, is reserved for "that class of cases characterised by severe symptoms, or by serious visceral derangement." We could include in this category malarial complications, which are usually visceral.

Malignant syphilis is stated to have been frequently seen in Europe in epidemic form in the fifteenth century, at the time when syphilis was supposed to have been first introduced into Europe from abroad by Columbus and his followers. The above term, "syphilis grave," would probably have met most of the cases. It was also seen in the Peninsular War in 1806. Heroic doses of mercurial salts, however, accentuated the symptoms and retarded cure. Ferguson says that he had been "destroying instead of saving patients by murderous and unnecessary courses of mercury. The error lay in the abuse, not in the use, of the mineral."[1] In the present day we notice that it is mainly from abroad, Burmah more especially, and chiefly at seaport towns with mixed populations which sailors frequent, that this class of disease is seen. It is rarely met with when prostitution is effectually supervised. Amongst women, primary syphilis increases in severity with the access of pyogenic organisms, with neglect and with the concomitants of famine, hunger and dirt.

We have ourselves noticed some twelve phagedænic secondary or tertiary cases in about 500 cases of syphilis amongst soldiers. Among 8,691 cases of syphilis treated in the Copenhagen Municipal Hospital during fourteen years, malignant syphilis was observed thirty-nine times, and with equal frequency in men and women. Professor Haslund says: "The name should never be applied to

[1] "Notes and Recollections of a Professional Life," p. 119, by W. Ferguson, M.D., Inspector-General of Military Hospitals. London, 1846.

cases of widespread tertiary ulceration. Extensive ulceration within one year of infection is usual in malignant syphilis. The disease, without treatment, even tends to a spontaneous cure." The phagedænic character of the manifestations, more marked in secondary, but frequently seen in the primary stage; the rapid destruction of soft tissues; the tendency to spread and recur; the liability to early suppurating necrosis of bone with well marked hectic fever, and the occurrence of tertiary lesions in some instances before the induration of the primary state has disappeared, stamp it as quite a distinct type of disease, and make it stand forth from the ordinary mild course of syphilis in a manner so evident and so clear, that the impression made on the mind is of the most vivid and lasting character. Amongst soldiers it is known as "black-pox," whether from the severity of the disease, or more probably from the supposed nature of its source from native races is uncertain. It appears to be due to an intense variety of infection, as it frequently occurs in robust and healthy men. We do not consider that the idiosyncrasy of the individual quite explains the severity. We consider, however, that the neglect of primary syphilis amongst native races would fully account for the increased virulence of the disease, when we consider how much neglect favours the advent of pyogenic organisms. The degree of infectivity is no doubt much increased in the case of the European by the implantation of the virus in a new soil from natives who thus habitually neglect their disease, so that the virus has not decreased in virulence. We find an analogue in the case of plague, in which disease virulence is decreased outside the body, but is markedly increased by passages through rats. No doubt the virulence of syphilis is similarly influenced by special conditions of blood in certain individuals. A marriage contracted outside our immediate sphere is commonly attended with benefit as regards the natural power of the offspring, who show commonly more stamina. So, too, syphilis transmitted from a vigorous to a less vigorous native, to a new or to a less resistant organism, is probably as potent in causing an exaggeration of severity in the person attacked. Haslund, of Copenhagen, thinks "that this type of syphilis is liable to occur in families where the ancestors have been but little affected with syphilis, so that there is little power of resistance against the disease." We exclude cases of syphilis complicated by the malarial poison from our conception of malignant syphilis. Fournier of Paris thinks the contrary. In Spain during the Peninsular War, the Spaniards were not so severely affected by syphilis as were the English. They communicated a virulent

form of the disease, but did not themselves apparently, contract a severe infection. Malignancy is not the result of, though undoubtedly aggravated by, climate and famine. Although famine may be epidemic, cases of malignant syphilis are usually sporadic in origin. We are inclined to think that neglect and the superimposition of pyogenic organisms, are the two chief factors in causing and maintaining malignancy, and are consequently the principal means of aggravating a severe infection after disease has been contracted. It is admitted that neglect of treatment in the early stages of syphilis predisposes to tertiary lesions, but in cases of malignant syphilis the tertiary deep type of ulceration is an ordinary feature of the disease. There is commonly progressive debility and anæmia from the onset, with a tendency to lung complications, septic bronchitis and low forms of pneumonia. These conditions may, or may not, be additional, accidental, and not due to the actual syphilitic poison, but they are most certainly aggravated by the extremely fœtid odour and by the acute suppuration from ulcers, or from necrosis in the buccal cavity. There is also liability in these cases to chill, from the concurrent condition of hectic fever, obstinate vomiting is frequent, as also are intense headache and absolute dejection of spirits. Malignant syphilis appears not to be directly influenced by alcohol, or by concurrent disease, such as tubercle. It is malignant from the first onset of secondary manifestations; and in many cases is quite independent of the misuse or of the abuse of mercury.

Whilst at Chatham in 1894, three men of the same corps had severe phagedænic primary disease, followed within two months by rupia, deep ulceration of fauces and palate, necrosis of bone, and later separation of a sequestrum in each case. As far as could be ascertained, the possible source of infection was the same. Other cases came under observation at Aden, where again several men, there is reason to suppose, contracted a severe form of infection from native sources. Although the characteristic of the disease is its early occurrence, yet it is undoubtedly true that malignant symptoms in rare instances may supervene later, the cause being wrapped in obscurity. Such cases have been seen; but should the term malignant syphilis be used to describe this class? For the sake of clearness in classification it is perhaps better to classify such "late" malignancy as merely severe tertiary. The "early" occurrence is the rule, to which this "late" variety forms the exception. As regards early or late malignancy, the practical result is the same for the surgeon. Early recognition of the actual condition is the real clue

to success in treatment. In malignant syphilis, secondary and tertiary symptoms, commonly ecthyma, or rupia, and extending ulceration, usually appear well within four months from infection. Cases not infrequently occur, however, in which well marked tertiary disease has appeared within six to twelve months, but these cases may not have presented any malignant characters, such as "extensive" ulceration or "early" rupia, throughout their course. It is erroneous to class them as malignant. The limits of time within which, in ordinary cases, the tertiary period is stated to have arrived, is vaguely laid down in text-books as several years after primary infection. This is perhaps the rule, the exceptions, however, are very numerous. Well marked tertiary lesions may occur well within the year; the third to the tenth year is, however, the usual period.

The rapidity of the destructive process, and the acuteness of the suppuration, are perhaps the most startling features in malignant syphilis. One week, a man is seen to have a typical hard chancre of the penis nearly healed, and the following week he is covered with ecthymatous crusts and the throat found to be sloughing. Within a month necrosis of bone with acute suppuration may have commenced, commonly starting in the jaws, and often aggravated by mercury and originating in dirty or carious teeth. A few scattered papules may precede the pustular rash on the skin; the ecthymatous crusts, however, are usually superimposed on flattened papules. In some instances there are underlying ulcers. The rash is usually markedly pustular in the early stages of malignant syphilis, and, as often the case with any severe syphilitic papular or pustular rash, attacks the face and head; in ordinary non-infiltrated rashes, the face nearly always escapes. Syphilis commonly attacks the forehead, head and extremities in the malignant type; just as it does in neglected cases, other than malignant, where prolonged treatment has been omitted in the earlier stages. If syphilis were not so much neglected, ecthymatous rashes, rupia and iritis would be very rarely seen; not infrequently the neglect of gonorrhœa leads to serious complications. It is the purely symptomatic and the commonly inadequate treatment of syphilis that usually gives rise to severe intermediary and later tertiary manifestations. The acuteness of the suppurative process surrounding necrosed bone areas is very marked in malignant syphilis, the pus flow being fast and continuous. Iritis is rare in our experience, but treatment is usually commenced early in the Service, owing to the cases being

seen in the primary stage, and continuously treated by mercury and potassium iodide, with tonics intermittently. These drugs may be quite powerless for a time, but later on act well if the general systematic condition is first attended to. The patient must be enabled by judicious dietary and port wine to take mercury or potassium iodide. The throat and mouth are usually attacked severely. Large gummata are rare, but cutaneous papules rapidly ulcerating and resembling large tubercles are not uncommon; the severity of the rash and throat lesions are usually proportional, and often associated with early tertiary disease of the larynx. Ulceration, of a phagedænic nature, not infrequently attacks pre-existing large infiltrated nodules around the mouth and nasal organs, and rapidly extends; these nodules are an early manifestation of the late relapsing syphilides. The fœtor that arises from the necrosing bone and from the breath is often so intense as to necessitate creosote inhalations, isolation and hourly dressings. Prognosis is favourable in most cases, but death may occur. The most favourable symptom when necrosis has occurred, is the sequestration of bone, when recovery rapidly ensues. Until this has occurred the disease will often progress in despite of all treatment. Death may occur from exhaustion caused by hectic fever, or from intercurrent disease; also from gummatous deposits in the lung, causing fatal hæmorrhage. Late chronic fibroid changes may occur. Fournier classifies all cases of syphilis complicated by ague as malignant syphilis. If so, malignant syphilis is very common in India. We remember to have seen on one occasion at Mhow, twenty cases invalided for secondary or tertiary syphilis; typical malarial cachexia was obviously present in five of them. These cases, although profoundly affected by ague, were not characterised by the extensive ulceration characteristic of malignant syphilis. Cases complicated by ague, although intractable, do not in our experience present the classical signs of malignancy, namely, severe or spreading ulceration. They are characterised rather by a progressive debility, by resistance to mercurial treatment, and by an anæmia presumably due to numerically deficient and physiologically defective red blood corpuscles. Tonic treatment is essential; mercury is commonly contra-indicated. We consider, with Dr. George Ogilvie, "that mercury may be greatly detrimental, and an additional source of severity." We have seen numerous cases of syphilis complicated and aggravated by the malarial poison; we do not, however, class them as malignant syphilis, nor do the symptoms occur early in the course of the disease, that is, within four to six

months, but usually after the sixth month and generally in the second or later years. We concur in the view that these cases are severe and resistant to treatment. The Turkish bath, massage, general nutrition and change of climate, are the chief therapeutic measures to be relied upon. We would class this type as "syphilis grave," as visceral complications are not uncommonly present.

As regards the treatment of malignant syphilis the giving of general tonics is commonly more useful than the routine use of specific drugs. The local application of antiseptic solutions and the removal of the products of pus formation is satisfactory the more frequently the applications are made. Trained attendants are required and rest in bed desirable, as the temperature in some cases may be 100° to 102° for a couple of months or more. Mercury may be discontinued for a few days during a sudden excessive rise of temperature; personal hygiene should be studied minutely, and the changes rung when one form of local application is found unsatisfactory.

Dilute Condy's fluid, in some cases of ulceration of the skin, appears to be more efficacious as an antiseptic lotion than solutions of mercury or of carbolic acid; iodoform preparations are especially valuable. The daily hot bath and prolonged soaking of diseased parts in warm water must be insisted upon, as the phagedænic nature of the ulceration is considerably aggravated by pyogenic organisms; this is more especially noticeable in the primary phagedænic ulcer. In the cases of severe ulceration of the throat, gargling is necessary for the same reason. Iodide of potassium can be tolerated in large doses in many cases, even up to one drachm three times daily. It often acts like a food, but it appears doubtful, however, with doses of over half a drachm, whether further benefit accrues. Opium is absolutely essential; it relieves the incessant pain, promoting sleep, and in cases of necrosed bone, assists nature in tiding over the long period before separation of the sequestrum can occur, when, as previously stated, recovery at once commences. Opium enables mercury to be given with less injurious effects, for the latter drug, though very useful, has to be used with great care when severe or phagedænic ulcers on the gums, or in the throat, exist. Mercury should be given in small tonic doses, half a drachm of the liquor hydrarg. perchlor. three times daily, combined with potassium iodide fifteen to thirty grains, and opium in liquid form. Inunction or mercurial vapour baths are especially valuable for pustular eruptions. Regarding the intramuscular injection of mercury in these cases, it appears to us to be contra-indicated. Stimu-

lants and nutritious foods, eggs, milk, beef-tea and port wine are essential in every case where malignant symptoms occur early or late in syphilis. It is especially necessary to divert the patient's thoughts from himself; this is often best secured by isolation, to avoid the too sympathetic expressions of friends. Sleep must be obtained; opium is the best soporific, and is also diaphoretic, being freely prescribed in doses of four to six grains daily in bad cases. When convalescence occurs, sea-side air is the best drug. Cod-liver oil and tonics, such as syr. ferri iodid. should be given, though these very often prove valuable throughout the case, if mercury and potassium iodide have failed. A useful line of treatment, if vomiting is present, is to rub ung. potass. iodid. into one groin and ol. morrh. into the other, every two hours. Relapses are very liable to occur within two or three months; if the relapse is promptly and satisfactorily dealt with, the future prognosis of the case is favourable, but every case must be decided on its own merits. Cure more frequently depends on the daily attention of the surgeon than mere dependence on drugs. The cases should be invariably treated as in-patients. Malignant syphilis is usually associated with prolonged fever; the place for such cases is in hospital. Should emergency require the cessation of all drugs, it is to be remembered that syphilis rarely kills, and that reliance may be placed on nature and in stimulating expectant treatment, dietetic or otherwise. Experience shows that these may frequently prove reliable when much vaunted specifics signally fail, and, too, when the case is apparently *in extremis*. As illustrating some of the points referred to, the following notes of actual cases, which have been under personal observation, may be of interest.

Case 1.—Private A., aged 22, admitted with primary syphilis. Hard chancre with phagedænic ulcer situated on corona glandis. Both groins equally and markedly indurated, the right groin later suppurated. Three weeks later a severe ecthymatous eruption appeared over the general surface of the body, mainly affecting the extremities and scalp. Simultaneously, severe sloughing phagedæna of the tonsils, uvula and soft palate occurred. Within another week gummata appeared in the left leg. Ulceration of the central portion of the gum, corresponding to the position of the pre-maxillary portion of the superior maxillary bone, shortly began. This portion suddenly necrosed and the sequestrum came away. The case was undoubtedly one of malignant syphilis. There was not any history of former venereal disease. The man belonged to a corps in which two other men were being affected in a similarly severe manner.

Treatment.—A hot bath every two hours until the sloughing of the penis ceased. The free use of iodoform and black wash on lint locally. Calomel vapour baths combined with mercurial inunction. To the throat, swabbing with equal parts of glycerine and sulphurous acid, calomel inhalations, and black wash gargle. This had immediate effect. Internally, liq. hydrarg. perchlor., half to one drachm, iodide of potash fifteen to thirty grains, and tinct. opii three minims, were given three times daily, doses varied. Diet, convalescent, in form of soup, port wine, beef-tea, milk, eggs and porter. After one month from admission to hospital the primary sore healed with much loss of tissue, rupia disappearing, throat resolving, but the ulceration of the gums developed into necrosis of the alveolus. A month later no external manifestation was evident, and the man was sent on two months' sick furlough, and advised to report himself at a civil hospital if the symptoms reappeared. They did reappear, but he neglected the advice and returned at the expiration of two months. On his return he was at once admitted to hospital with extensive necrosis of the alveolus of the superior maxilla, necrosis of hard palate, with perforation into the nasal cavity, extensive ulceration of the pharynx, and probably larynx, as there was loss of voice, which was later permanent. Treatment as before, with great attention to diet and extras. Two months later, a sequestrum of bone came away corresponding to the premaxillary portion of the superior maxillary bone. Resolution at once began, and the other symptoms gradually cleared. Permanent loss of voice remained, and he was subsequently invalided out of the army.

Case 2.—Private B., admitted to hospital in 1894 for considerable hypertrophy of tonsils. The tonsils were removed. Two months later admitted with primary syphilis. The chancre situated on the glans penis of considerable size, erosive in nature, but without very evident induration, with a tendency to phagedæna. The inguinal glands were equally shotty on both sides, discrete, and the size of small marbles. A pustular rash with severe ulceration of both sides of the fauces appeared within the month. The ulceration of the throat spread to the soft palate, which sloughed, and on to the posterior wall of the pharynx, which necrosed, within three months of admission to hospital with the primary disease.

Diet and treatment as in the case of Private A. No improvement in the throat, which went from bad to worse. The rash disappeared, but intense debility and anæmia followed. The patient could not swallow solid food. Liquids were regurgitated through

the nostrils, necessitating feeding with nutrient enemata. Food was vomited from the stomach. The case lingered between life and death for several months, the man a mere skeleton, absolutely confined to his bed, unable to move from weakness. After eight months, during which time every form of treatment was tried, including large doses of mercury and iodide of potassium, separately and together, he was placed under the charge of four hospital orderlies, who were directed to rub iodide of potassium ointment into the right groin and ol. morrhuæ into the left every two hours. After a month, a sequestrum of bone the size of a small walnut came away from the posterior wall of the pharynx. Hectic fever, which had previously been present for months, disappeared. The local lesion resolved. The man gradually became sufficiently convalescent to proceed to the sea-side. On his return no signs of active disease were present. After having been a year continuously under treatment, mainly in hospital, he was left with a permanently broken-down constitution, and was discharged from the Service.

Case 3.—Private C. Primary syphilis, June 23rd, 1893. Aged 20. In hospital sixty days. Secondary syphilis followed. Mercury and local treatment. Discharged clear of symptoms, August 20th, 1893. No return of symptoms until January 28th, 1895, when he was admitted to hospital with an indolent bubo of large size in the right groin and an ulcerated throat. Whilst in hospital suppuration of the glands in the groin occurred, and the glands were excised under chloroform. Mercury and potass. iodid. given throughout. Discharged from hospital June 28th; readmitted November 9th. "Secondary" syphilis twenty-four days; lesion unstated; mercury and potass. iodid. internally. Readmitted March 8th, 1896, with secondary syphilis twenty-seven days; bubo only, which was incised. Mercury and potass. iodid. No admission to hospital again until March 20th, 1897, when he was admitted under our care at Aden, with secondary syphilis. Sore throat only, no other lesion. There was a yellow-green indolent mucoid slough of chronic type on the posterior wall of the pharynx and on the tonsils. Ten days later a mucous patch developed on the upper gum at the base of a carious tooth. Mercury was given; the teeth were very dirty; stomatitis ensued, the gum ulcerating on the inner side and extending to the outer surface of the base of the upper central incisor teeth. The ulcer was touched with nitrate of silver and improved, but relapsed. Inhalations of calomel combined with tonics of phosphoric acid and nux vomica caused improvement.

The gum again relapsed and fever ensued for a week; quinine and fever remedies prescribed. The temperature becoming normal, mercury and potass. iodid. combined with opium were given internally. Locally, a gargle of potass. permang. with iodoform as a tooth powder. The ulcer was then the size of a florin, and the two central upper incisor teeth dropped out, active necrosis commencing in the base of the cavities. Subsequently the upper jaw necrosed for one inch on either side of the median line and the teeth dropped out.

The cavities of the teeth were syringed hourly and packed with iodoform on lint steeped in black wash. The temperature rose to 101° and remained so for ten days. On April 27th, 1897, temperature normal; mercury, pot. iodid. and opium were again given in liquid form by the mouth. Mercury had been discontinued when the ulceration around the incisor teeth extended.

May 7th, 1897.—Marked improvement. The ulcers of the gum bleeding but looking more healthy. Great constitutional debility, with hectic fever from absorption of the products of decomposition. The hard palate ulcerated. Tonics, port wine, eggs, milk, and brandy given in addition to the diet. The temperature varied from 100° to 103° for the next three months, never becoming normal. June 28th.—Ung. pot. iodid. rubbed into the groins and glands of the neck four times daily. Cod-liver oil and specific drugs given internally. Hypodermic injections of morphia half a grain to relieve the intense pain. Ulcers in the mouth swabbed with sulphurous acid and glycerine. Inhalations of creosote and tincture of iodine. July 7th.—Necrosis of the alveolus more marked, but the previously profuse suppuration is less. Ulceration of the uvula and necrosis of the hard palate began. The upper lip attacked, the tissues having disappeared for an inch and a half on either side of the median line, leaving an infiltrated and thickened surface healing at the centre and spreading peripherally. Extensive phagedænic tertian ulcers. 30th.—The lower lip and both angles of the mouth are involved in the ulcerating process, but healthy granulation tissue is appearing on the upper lip. Pot. iodid. increased to four drachms daily by the mouth, and fifteen grains in ointment. August 6th.—Perforation of hard palate. Uvula improved. Sleeps eight hours in twenty-four. Opium reduced from six to three grains daily. 15th.—Acute ulceration of upper lip, which now involves the alæ nasi. Extension of ulceration of the lower lip. Ordered face bath of liq. hydrarg. perchlor. (1 in 2,000), the surface of the ulcer washed with 1 in 250 liq. hydrarg perchlor. and ung. iodof. and ung. hydrarg. with

vaseline applied. September 6th.—Both lips markedly better, cessation of ulceration. Alæ nasi have disappeared to the extent of half an inch. Septum nasi attacked by necrosis. The tertiary ulcers on the tonsils, pharynx and soft palate resolved. Condy's fluid face bath substituted for the mercurial one with marked benefit. Ung. hydrarg. nit. with ung. iodof. applied with benefit to the margin of the ulcer near nose. General health much improved. 25th.—Convalescent. No signs of active disease. All ulcers healed over. Considerable loss of tissue and great disfigurement. The man has a wolfish appearance of face. October.—Invalided to Netley, England. This case no doubt formed one of a class, if not one of the cases, so vividly described by the committee who reported on syphilis at Netley.

REPORT ON ENTERIC FEVER AMONG THE *PERSONNEL* OF NO. 4 GENERAL HOSPITAL, MOOI RIVER, NATAL, WITH REFERENCE TO DRINKING-WATER FILTRATION.

By Lieutenant-Colonel H. H. JOHNSTON, C.B.
Royal Army Medical Corps.

During the thirty-one months No. 4 General Hospital was open, from January 6th, 1900, to July 31st, 1902, in the course of the recent South Africa Campaign, thirty-nine cases of enteric fever were contracted at Mooi River, among 1,167 warrant officers, non-commissioned officers, and men of the *personnel* employed in the hospital. The average strength of the *personnel* during this period was 183.

During the first five months, January to May, 1900, when Nordtmeyer-Berkefeld filters were employed for filtering the drinking-water, thirty-one cases of enteric fever were contracted among the *personnel*, whereas, during the next twenty-six months, June, 1900, to July, 1902, when Pasteur-Chamberland filters were in use, only eight cases of this disease occurred.

During the first period, when Nordtmeyer-Berkefeld filters were in use, enteric fever was prevalent among the whole *personnel* of the hospital, but, in proportion to strength, about three times more prevalent among the *personnel* employed in other parts of the hospital than it was among the *personnel* employed in the enteric fever wards. The general prevalence of enteric fever may be accounted for by a common source of infection, such as contaminated drinking-water, while the greater prevalence among the *personnel* employed in other parts of the hospital than the enteric fever wards may be partly explained by the large number of unrecognised cases of enteric fever in patients transferred from other hospitals to the surgical division of No. 4 General Hospital, in which special and adequate precautions to prevent the spread of the disease were not taken before the true nature of the disease was recognised. After August, 1900, all cases of "simple continued fever," "dysentery," and "diarrhœa" (many of which turned out to be enteric fever) were isolated in the medical division, and the same sanitary precautions as for enteric fever were taken, with

marked benefit, in preventing this disease from spreading to the ward orderlies and other patients.

During the second period, when Pasteur-Chamberland filters were in use, enteric fever was not generally prevalent, and of the eight cases of this disease five were contracted among the *personnel* employed in the enteric fever wards, in which the disease may have been contracted, and one in an orderly employed in the pack store, in which he may have contracted the disease by handling infected clothing, leaving the source of infection of only two cases unaccounted for during a period of twenty-six months.

The annexed return shows the months in which the thirty-nine cases of enteric fever occurred among the *personnel*, and the parts of the hospital in which the individuals were employed at the time they contracted the disease.

From experiments conducted by me in the Public Health Laboratory of Edinburgh University, in 1893-1894, I found that, after two to ten days' continuous filtration, the Nordtmeyer-Berkefeld filter allowed micro-organisms to pass through, and a few days later the number of micro-organisms present in the filtered water was often enormously greater than the number present in the unfiltered water, thereby showing that the filter formed a breeding ground for micro-organisms; whereas, in the case of the Pasteur-Chamberland filter ("candles" stamped "B"), working under precisely the same conditions as the Nordtmeyer-Berkefeld filter, the water was completely sterilised during six weeks' continuous filtration, under pressures ranging between 13 lbs. and 46 lbs. to the square inch. The results of these experiments were published in a Thesis for the degree of D.Sc. in Public Health, on August 1st 1894, and they have been amply corroborated by subsequent experiments.

During the period the Convalescent Depôt was at Mooi River, from March 25th, 1900, to July 2nd, 1900, large numbers of men in the early stage of convalescence from enteric fever were accommodated in it, and 146 patients suffering from this disease were admitted from it into No. 4 General Hospital. The surface drainage of the Convalescent Depôt Camp entered the Mooi River from 30 yards to 170 yards above the intake of the water supply of No. 4 General Hospital, but on the opposite bank of the river, which is about 40 yards broad. If, therefore, the river water were infected with enteric fever bacilli, it is probable that the bacilli passed actually into and through the pores of the Nordtmeyer-Berkefeld filters and contaminated the drinking-water of the hospital.

A large automatic syphon-action Pasteur-Chamberland filter (of 336 "candles" stamped "F," which filter about three times as rapidly as those stamped "B") was taken into use on June 2nd, 1900, and eleven days later (allowing for the period of incubation) enteric fever, which, up to then, had been very prevalent, ceased almost altogether, and only eight cases of this disease occurred during the next twenty-six months, compared with thirty-one cases during the first five months, when Nordtmeyer-Berkefeld filters were in use.

Return of Thirty-nine Cases of Enteric Fever Contracted at Mooi River among 1,167 Warrant Officers, Non-Commissioned Officers and Men of the *Personnel* of No. 4 General Hospital, Mooi River, Natal, between January 6th, 1900, and July 31st, 1902. Average Daily Strength of *Personnel*, 183.

Date	Cases of Enteric Fever	Places where Employed in the Hospital											
		Enteric Fever Wards in which 45 per cent. of the *Personnel* were employed	Other Parts of the Hospital in which 55 per cent of the *Personnel* were employed										
			Surgical Division	Officers' Wards and Kitchen	Patients' Kitchen	Officers' Mess and Kitchen	General Sanitary Duty	Provision Store	Sergeants' Mess	Men's Tents	Registrar's Office	Pack Store	Total
1900													
January ..	3	1	—	—	—	1	1	—	—	—	—	—	2
February ..	4	1	3	—	—	—	—	—	—	—	—	—	3
March ..	5	1	1	—	1	1	—	1	—	—	—	—	4
April ..	13	3	6	1	—	—	1	—	1	1	—	—	10
May ..	6	1	2	1	1	—	—	—	—	—	1	—	5
June ..	1	1	—	—	—	—	—	—	—	—	—	—	—
August ..	1	1	—	—	—	—	—	—	—	—	—	—	—
October ..	1	—	—	—	—	—	—	1	—	—	—	—	1
November ..	1	—	1	—	—	—	—	—	—	—	—	—	1
1901													
February ..	2	2	—	—	—	—	—	—	—	—	—	—	—
December ..	1	—	—	—	—	—	—	—	—	—	—	1	1
1902													
February ..	1	1	—	—	—	—	—	—	—	—	—	—	—
Total ..	39	12	13	2	2	2	2	2	1	1	1	1	27

A private Pasteur-Chamberland filter ("candles" stamped "F") was in use in the officers' mess, and boiled drinking-water was used by the nursing sisters of No. 4 General Hospital from January to June 1st, 1900, until the public Pasteur-Chamberland filter was taken into use on June 2nd, 1900, for the whole hospital *personnel*, including officers, civil surgeons and nursing sisters, and there was not a single case of enteric fever, nor a single death from any cause,

among the fourteen officers Royal Army Medical Corps (average strength six), forty-four Civil Surgeons (average strength nine), and fifty-six nursing sisters (average strength eighteen) who did duty in the hospital during the two years and seven months the hospital was open.

If Nordtmeyer-Berkefeld filters are employed for filtering drinking-water, they should be sterilised by boiling in water for at least one hour every second day. On field service this is impracticable; and, as a matter of fact, in actual practice the filters were seldom or never sterilised, and, in my opinion, their use was a source of danger to the health of the troops.

A MODIFICATION OF THE TELEPHONE BULLET EXTRACTOR.

By Captain WILLIAM SHEEN.
Royal Army Medical Corps (Vol.).

In the *Lancet* of September, 17th, 1904, I published an account of a case in which a revolver bullet entered a man's forehead and lodged 12 cm. from the point of entrance in the hinder part of the left callosal convolution, and was extracted seventy-three days later through an opening in the cranium behind the left mastoid process, at a depth of about 7 cm. from the surface of the head. Localisation was obtained by means of the Mackenzie-Davidson apparatus. The man recovered and returned to work.

This account should be compared with that of a very interesting case recorded by Mr. A. E. Barker in the *Lancet* for December 2nd, 1899. In this case a revolver bullet entered the roof of the mouth, and was extracted sixty-nine days later, through the skull vertex, from a depth of about 5 cm., being lodged on the upper surface of the corpus callosum. Localisation was obtained by means of antero-posterior and lateral skiagraphs. Recovery—not quite complete, and certain complications—followed.

A study of these two cases will, I think, suggest that localising methods have been brought to a considerable degree of exactness, but the means of instrumentally detecting and extracting the foreign substance are still imperfect. As far as possible we require to obviate the necessity for the reintroduction of instruments. In Mr. Barker's case there was a "considerable amount of unsuccessful probing," and the little finger had finally to be passed down to the bullet to act as a guide to the extracting forceps. Thus some additional damage to and loss of cerebral cortex resulted. To this may be set down in part the continuance of epileptiform seizures, necessitating a second operation, when adhesions between the two hemispheres were found and separated. In my own case the telephone probe at my disposal was for some reason ineffective. I had no graduated probe or graduated forceps, and I therefore had to measure and scratch off distances on the instruments that I used. Although, therefore, I was fortunate enough to extract the bullet at the second attempt, my appliances were by no means perfect.

The ordinary Hedley's telephone probe is well known. No battery is required. The silver plate attached to one wire of the

telephone receiver is placed on an indifferent part of the body, and the silver probe attached to the other wire is used to detect the foreign substance. The silver plate forms one pole of a battery, the foreign substance (lead or nickel-covered bullet, fragment of steel, needle, &c.) forms the other, while the body itself acts as the electrolyte. When the circuit is completed by the probe touching the foreign substance, a current is produced and a sound is heard in the telephone. This sound is usually called a "buzzing," but is better described as a "crepitating" noise. The greater the potential difference between silver and the metal of which the bullet or other foreign substance is composed the more pronounced the crepitation. Lead, iron and nickel are some distance from silver in the electromotive series of metals, which runs thus in dilute acid, being probably approximately the same when the dilute acid is replaced by the body fluids.

+ Zn, Cd, Sn, Pb, Fe, Ni, Bi, Sb, Cu, Ag, Au, Pt—

A distinct noise is therefore produced. This noise may be obtained experimentally on another individual who holds a bullet between his lips. When the bullet is replaced by gold a very slight noise, when by zinc a very distinct noise, is produced. These and similar tests show experimentally the approximate accuracy of the above scale under the circumstances.

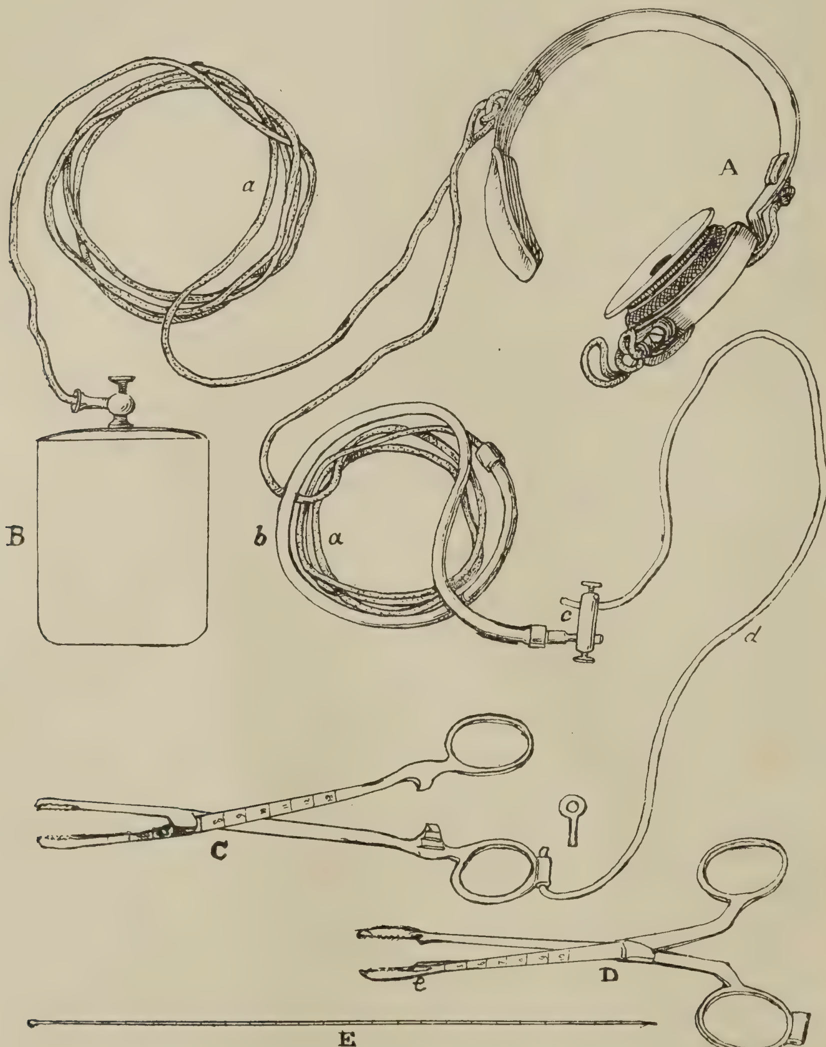
Although the detecting probe is usually made of silver, like the body plate, yet this, as can be easily shown experimentally, is not essential. The only essential of the telephone detector is that the body plate and the foreign substance should be well separated in the electromotive series. Silver is seen to be the metal which most conveniently fulfils this indication. In order to increase its utility, and to ensure asepsis when it is in use, I have modified and added to the apparatus as follows:—

(1) The wire connecting the probe with the telephone receiver has a fixed covering of rubber for two feet nearest to the probe. This part of the apparatus can therefore be boiled or immersed in a disinfectant.

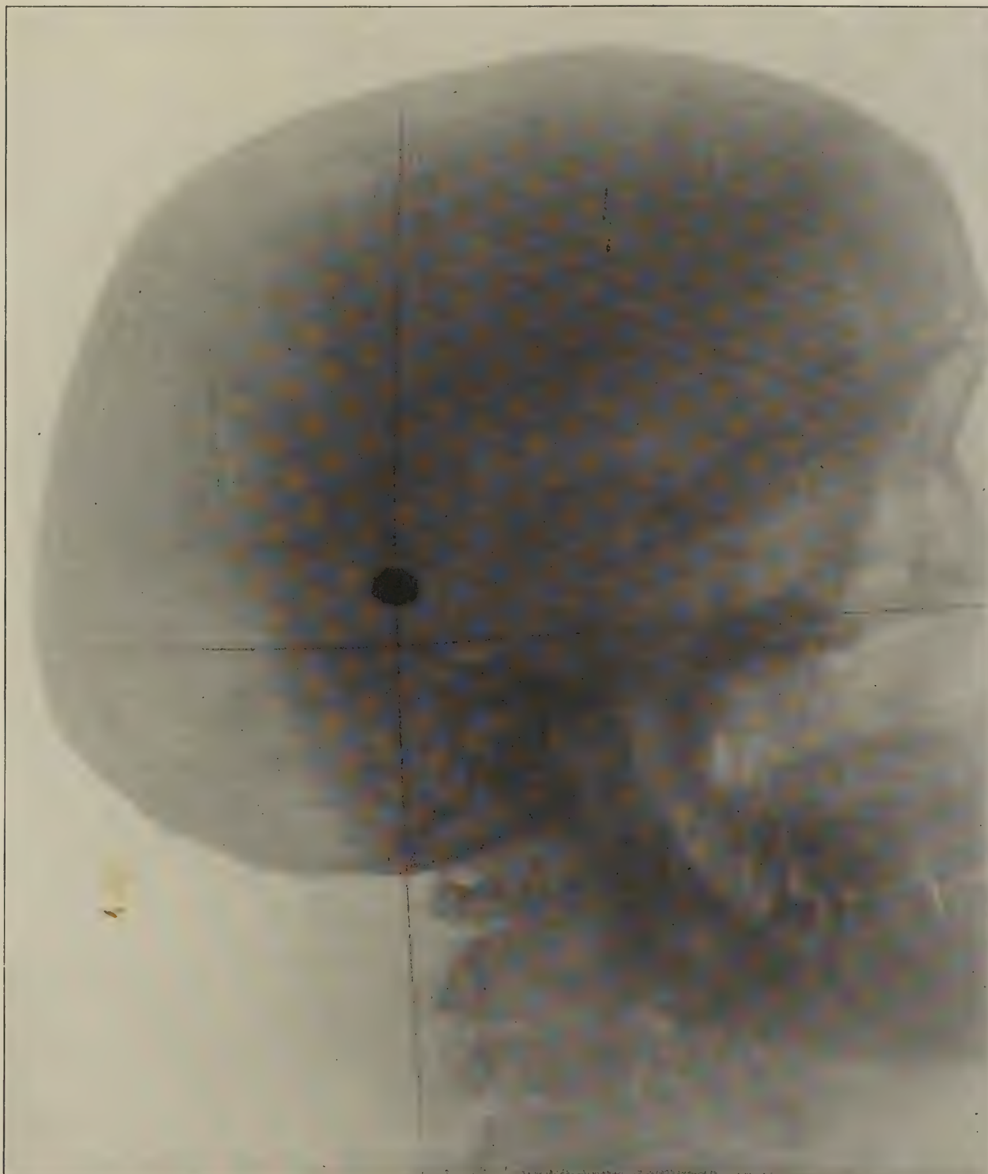
(2) The silver probe used is graduated in centimetres. This probe retains its original form, blunt at one end and pointed at the other.

(3) Two pairs of forceps have been constructed. They are graduated in centimetres from the extremities of their jaws. The smaller pair is a slender, rounded forceps, 17 cm. long, and is intended especially for brain work, having the joint situated as near to the handles as is consistent with adequate rigidity, so as to

minimise the excursion of the blades. The larger pair, 21 cm. long, is more strongly constructed for general work, and is in pattern similar to the well-known "French" model of bullet forceps.



A, Telephone receiver with headpiece. B, Silver body plate. C, Larger bullet forceps. D, Smaller bullet forceps. *a*, *a*, Conducting cords. *b*, Cord covered with rubber. *c*, Clamping piece. (An additional one is provided, not shown in the figure.) *d*, Stout silver wire. *e*, Commencement of groove on jaw of forceps.



To illustrate Paper by Captain WILLIAM SHEEN.

" A Modification of the Telephone Bullet Extractor."

(4) In each pair of forceps the jaw part of one blade is grooved obliquely on its interior from base to point, the groove running a very short distance on the outer aspect of the forceps. When the probe has detected the foreign substance, this groove permits the forceps to be slid along the probe down to it.

(5) For attaching the forceps to the telephone wire, a piece of stout silver wire (No. 6 French catheter gauge) is used. This wire fastens into an attachment on the handle of the forceps. The use of this wire permits all parts of the apparatus that may come into contact with the wound area to be sterilised by boiling.

If desired, the silver wire can also be used for attaching the probe to the telephone wire, two "clamping pieces" being used; but having the wire rubber-covered, as described, prevents this being absolutely necessary. I have recently had an opportunity of testing the apparatus. The patient, a male adult, was sent to me by Dr. Havard, Newport, Pem. A small bullet was embedded deep in the thigh against the surface of the femur, and the larger forceps easily detected and extracted it. The method of use of the telephone detector would vary according to the exact nature of the case. Where, for example, the bullet was embedded in the substance of the brain, there being no definite bullet track, the wisest plan would be to first find the bullet with the blunt end of the probe and then to slide the smaller pair of forceps along the probe. A fragment of steel or a needle buried deep in the tissues would best be detected by the sharp end of the probe. A fairly definite bullet track in any situation would indicate immediate recourse to one of the pairs of bullet forceps or "bullet probe forceps," as it might be called, for the same instrument detects and extracts the bullet.

Accompanying this communication is an excellent skiagraph of the bullet *in situ* in my own case (referred to above), taken by my colleague, Mr. William Martin, in the X-ray department of the Cardiff Infirmary. This particular skiagraph was taken from the *right* side of the skull, *i.e.*, from the side furthest from that on which the bullet lodged. The bone deficiency at the site of the aperture of entrance is well shown, and also the shadow of a fragment of lead which remained near it.

The instruments that I have described have been made for me by Messrs. Down Bros., to whom I am greatly indebted for the care and attention that they have given to their construction.

NOTES ON SEVEN CASES OF PERFORATING GUNSHOT WOUNDS OF THE SKULL.

By Major G. E. MOFFET.
Royal Army Medical Corps.

Of the large number of cases of gunshot wounds of the skull which must have been operated on in the various hospitals in South Africa during the late campaign, in only a few have the remote effects of the injuries been recorded.

Mr. Makins, in his "Surgical Experiences," notes the condition of some cases, at the end of periods varying from seven months to a year after receipt of the injuries, and Lieutenant-Colonel Lougheed describes, in the Corps Journal of August and November, 1903, the condition of two men (Cases 2 and 13) operated on eighteen and twenty months previously. The following notes will therefore prove of some interest, inasmuch as six of the men have been traced, and their condition ascertained after the lapse of nearly five years.

In the first five cases the wounds were received at the attack on Magersfontein, December 11th, 1899, and the patients operated on in No. 4 Sectional Field Hospital; the other two men were wounded at Paardeberg, on February 17th and 18th, 1900, respectively, and were ultimately transferred to, and operated on at, the Detachment No. 5 General Hospital, Orange River.

Case 1. *Fronto-parietal Perforating Fracture* (*Mauser*).—No. 6554 Private J. D., 1st Argyll and Sutherland Highlanders, aged 19, service one year, was admitted on December 13th, 1899. The wound of *entrance*, received while the man was retiring, was small and circular (half an inch in diameter), and was situated over the right parietal eminence, three and a half inches above Reid's base line, and three inches posterior to meatus. A piece of depressed bone could be distinctly felt beneath the margin of the bony aperture. The wound of *exit*, much larger than that of entrance, with irregular and jagged edges, was situated somewhat posteriorly to the right frontal eminence, about five and a half inches above base line, and two inches anterior to meatus. A considerable quantity of brain substance protruded from this wound.

Condition on Admission.—Temperature 99·8° F., skin moist, pulse 45 per minute, and very compressible, breathing regular; patient was very depressed and drowsy, complained of great thirst and intense

Fig. 1 (Case 1).—Showing muscular atrophy of upper and lower limb on left side.

Fig. 2 (Case 1).—Showing condition of left hand and fingers.

To illustrate Paper by Major G. E. Moffet.

"Notes on Seven Cases of Perforating Gunshot Wounds of the Skull."

headache, and was very deaf; there was a slight sanguinolent discharge from both ears; pupils widely dilated and sluggish; restlessness was a very marked feature, the patient rolling his head from side to side and at intervals screaming out as if in great agony. There was left-sided hemiplegia, partial in lower, complete in upper, limb, with pronounced wrist-drop, left facial paralysis, and paresis of bladder and rectum. Sensation considerably impaired in both limbs; decubitus towards left side, with the right leg slightly flexed and thrown over the left.

Operation.—The patient, having been prepared in the usual way, on December 14th a wide semi-circular flap including both wounds was deflected, and after removal of a large quantity of pulpified brain substance and some clots from the neighbourhood of both wounds, the trephine was applied at the posterior edge of the aperture of entrance, and a piece of deeply depressed bone, three-quarters of an inch in diameter, was elevated and removed; some more clots and disorganised brain substance, together with several splinters of the internal table, which had been driven through the lacerated dura, were also removed. At the aperture of exit both tables were found much splintered, necessitating the removal of several small spicula and some pulpified brain substance. There was a considerable amount of fissuring in the neighbourhood of both apertures, the radiations, which apparently only affected the outer table, extending backwards and laterally from the aperture of entrance, and anteriorily and laterally from that of exit. One of the fissures from the aperture of exit extended anteriorily for a distance of two and a half inches, while the lateral radiations reached the temporo-parietal suture, which was loosened along its middle third. Both apertures were well bevelled, the wounds irrigated gently with a warm saturated boric solution, the deflected flap sutured into position, and a dry cyanide dressing applied.

Subsequent Progress.—The evening after the operation patient's temperature rose to 100·4° F., and for two successive evenings registered 100° F.; during this time he was still restless, occasionally screaming out, but not so frequently as before. He answered questions quite rationally, and there was a decided improvement in his sense of hearing on the left side. During the next five days there was a gradual but steady amelioration in patient's condition; he slept well, had ceased to scream out as before, and had regained complete power over bladder and rectum; the operation incision had healed; there was marked improvement in sensation of both limbs; motor power of lower limb considerably, that of upper

limb very slightly improved, but only as regards the arm; there was no visible improvement in motor power of fore-arm or hand; pupils normal and responsive to light; slight discharge still continued from both ears. Such was the patient's condition when he was transferred to the base, in No. 1 ambulance train, December 22nd. He was eventually invalided home, but prior to this was seen by Civil Surgeon T. E. Stuart, who, writing on February 18th, 1900, stated: "Private D. is quite convalescent, but his centre for movement of left arm, I am afraid, is destroyed." Surgeon-General W. J. Charlton, late Principal Medical Officer, Netley, in a letter dated July 16th, 1900, kindly furnished me with the following notes regarding this patient: "Private D. was discharged 'unfit.' On discharge, loss of power in left arm was nearly complete, but sensation present; partial loss of power in leg, but the leg has improved greatly. Had otorrhœa in both ears; at present no discharge, but membrana tympani of right side completely gone; middle ear inflamed."

After discharge from the service this man joined the Corps of Commissionaires in Glasgow, and is at present employed working a lift in a large warehouse in that city.

Present Condition.—I have seen him several times between March, 1902, and the present date. The last time I examined him (August 22nd, 1903, when the accompanying photographs were taken) his condition was as follows: General health excellent; both openings in skull marked by slightly depressed cicatrices, are closed by apparently bony material; no headache, nor pain on pressure over cicatrices complained of; mental condition quite normal, and he has never had any convulsive seizures or fits; sight, taste and smell normal, and hearing on left side almost so (watch heard at twenty-eight inches from ear), but on right side he is practically deaf (watch only heard when in actual contact with ear), and he occasionally complains of slight tinnitus on this side, but there is no perforation, nor any discharge from either ear; patellar tendon reflex normal on right, greatly exaggerated on left side; no impairment of sensation in either limb nor in face; gait somewhat hemiplegic, but he walks quite well without (although better with) the aid of a stick; muscles of both upper and lower limbs somewhat atrophied, as compared with those of right side, the wasting being most marked about shoulder and upper limb generally, and round calf of leg (fig. 1.); he can move the shoulder very well, the elbow and wrist a little, but the hand is useless, the fingers being semi-flexed, contracted, and

clubbed at extremities, and the thumb flexed and drawn into the palm (fig. 2); the motor power of facial muscles is completely restored, tongue protrudes in middle line, and there is no difference in the two sides of face. The wasting of the muscles is not brought out in fig. 2, owing to the greater proximity of left side of body to camera.

CASE 2. *Fronto-parietal Perforating Fracture* (*Mauser*), *involving Left Rolandic Area.*—No. 6887 Private R. D., 2nd Royal Highlanders, aged 22, service two years, was admitted on December 13th, 1899. The wound of *entrance,* received while the man was retiring, was situated over left parietal eminence, that of *exit* an inch to the left of the sagittal, and bordering on left coronal suture, a distance of four inches intervening between the wounds. A large quantity of pulpified brain matter protruded from the wound of exit.

Condition on Admission.—The patient was very drowsy and languid; skin moist, temperature 99° F., pulse 60; no vomiting, but intense headache and thirst were prominent symptoms; pupils widely dilated; there was right-sided hemiplegia, with impaired tactile sensibility (face and tongue involved), and paresis of bladder and rectum; the patient was aphasic, unable to protrude his tongue, and speech was limited to the monosyllables "yes" and "no." The day after admission he had several epileptiform convulsions, the head and eyes being always directed towards the right shoulder, *i.e.*, away from the injured side.

Operation.—On December 15th, Captain Hennessy, R.A.M.C., deflected a semi-circular flap including both wounds, and exposed a small depressed fracture at the wound of entrance, at the posterior angle of which the trephine was applied, and the depressed bone elevated and removed, together with some small fragments of the inner table more deeply embedded in the brain. From the aperture of exit a large quantity of pulpified brain substance and some small spicula were removed. Both bony apertures were bevelled, the scalp wounds, which were in an unhealthy condition, were incised, and after gentle irrigation with saturated boric solution, the flap was sutured into position, and a dry cyanide dressing applied.

Subsequent Progress.—Convulsive seizures continued for two days after operation, and although there was a slight improvement in speech, and in the motor power of lower limb, there was no control over bladder or rectum until December 20th. On transference to the base, three days later (by ambulance train), his temperature was normal; there was a marked improvement in

motor power of both limbs (especially in that of lower), but sensation was still impaired; abdominal reflexes absent, cremasteric reflex present, but not active; pupils still widely dilated; tongue could not be fully protruded, but there was a marked improvement in his speech.

This man stood the journey to the base very badly, and on arrival at Wynberg a second operation was necessary, owing to a hernia cerebri having formed. The removal of this, together with some loose bone, was followed by a general amelioration in patient's condition; but a fortnight later another operation was performed, owing to the formation of a cerebral abscess, which was tapped, and an ounce of pus withdrawn; a third operation was performed about a month later, when the track into the cavity was enlarged, and the cavity itself drained. After this the case did well, and when invalided home at the end of March, 1900, he had recovered his speech, but his right arm was very weak.

On July 16th, 1900, Surgeon-General Charlton reported from Netley as follows: "Condition much improved; hemiplegia almost gone; no epileptic fits for some weeks; wounds not quite healed; transferred to Station Hospital, Edinburgh, to make room for other expected invalids."

Present Condition.—On August 16th, 1903, when I last examined him, he was to all appearance in robust health; speech perfect; sensation and motion in both limbs normal; walks without any halt whatever; no wasting of right as compared with left lower limb; knee-jerk normal; in the upper limb there is slight wasting of the supinator muscles, and of the thenar and hypothenar eminences; the grasping power of hand is weak, three-fourths as compared with the left hand, and the right little finger is slightly contracted; special senses are normal, but as he complained of some dimness of vision, Dr. Kinnear, of Dundee, kindly had him examined, at my request, by Dr. Angus McGillivray (Surgeon to the Dundee Eye Infirmary), to whom my thanks are due for the following report: "Right vision six-sixths partly, and left vision six-ninths. The defect in vision is due to a refractive error, namely a trace of astigmatism in the right eye, and a slight mixed astigmatism in the left. The fundi, media and lenses are normal in both eyes, and the pupils react normally to light and accommodation. The fields of vision are normal for form and colours. In short, I find no ocular trouble except the slight refractive error referred to." He complains of slight giddiness on exertion, and occasional headache, which is, however, not very severe. He still has an epilepti-

form fit occasionally, but the intervals between successive attacks appear to be gradually increasing, and the severity of each attack diminishing ; the last fit he had was a week ago (August 9th, 1904), and the one before this on December 31st, 1903, *i.e.*, over seven months ago.

CASE 3. *Frontal-parietal Perforating Fracture (Mauser).*—No. 6573 Private J. A., 1st Argyll and Sutherland Highlanders, aged 22, service two years, was admitted on December 13th, 1899. The wound of *entrance* was situated two inches above inner extremity of right orbit, that of *exit*, from which brain matter was protruding, four inches above right external auditory meatus, the track being through upper third of right ascending convolution.

Condition on Admission.—Temperature normal ; the only symptom complained of was very intense headache; there was no paralysis.

Operation.—On December 15th Civil Surgeon T. E. Stuart explored the wounds by raising two small semi-circular flaps, embracing each wound separately. Several small loose fragments of bone, which had been driven into the brain at the aperture of entrance, were removed, the margins of the aperture having been enlarged for this purpose with gouge forceps. At the wound of exit a large quantity of protruding brain substance was removed, also some clots ; but as the brain did not pulsate after removal of these, and no bony fragments could be detected, the wound in the dura was enlarged, and a small subdural clot removed, after which the brain pulsated freely. After gentle irrigation of the wound, both flaps were sutured into position, and a dry cyanide dressing applied.

Subsequent Progress.—The day after operation the patient was seized with an epileptiform convulsion, the temperature, which until now had been normal, rising to 100° F. This was the only convulsive seizure the man had, but his temperature rose to 100° F. on three successive evenings. Beyond this there was not a single bad symptom ; the operation incisions healed by first intention, and when patient was transferred to the base by ambulance train, on December 22nd, the headache had quite gone, and all reflexes were normal. On February 18th, 1900, Mr. Stuart saw this man at the Base Hospital, Wynberg, and reported him as " quite well, and awaiting passage to England." On July 16th Surgeon-General Charlton reported from Netley: "Cannot find any notes of this case. He was sent on furlough on May 3rd (presumably 'fit')." He eventually rejoined his regiment, has since been promoted sergeant,

and is at present serving as orderly room clerk. Lieutenant-Colonel E. H. Lynden-Bell, R.A.M.C., who, at my request, very kindly examined this man, in conjunction with Lieutenant Hildreth, on August 22nd, 1904, reported as follows: "I have examined Sergeant A., with Lieutenant Hildreth, whose opinion I send you. He is extremely nervous, and the heart's action is very rapid. Pulsation can be felt at the wound of entrance, and the bone is somewhat depressed. His pupils are equal, reflexes normal, and all the senses also normal. He has lost a stone weight, and is very pale." Lieutenant Hildreth writes: "The cicatrices of the wound are still very evident, that of entry by a depression, in which pulsation is perceptible. His senses are unimpaired; reflexes normal; sensory and motor systems normal. He states he feels perfectly well, but occasionally experiences a peculiar sensation on the side of the head affected, especially when the head is low (compares it to a rattle). He appears to be very nervous indeed, and states this condition has been exaggerated. The heart's action is somewhat disordered. Habits temperate. Is very anæmic, and has lost a stone weight." My thanks are due to both these officers for the above reports.

CASE 4. *Fronto-parietal Gutter Fracture* (*Mauser*).—No. 5865 Private J. M., 2nd Royal Highlanders, aged 23, service two years, was admitted on December 13th, 1899. The wound of *entrance* was situated two inches above and the same distance anterior to the left auditory meatus; that of *exit* five inches above and nearly an inch posterior to the meatus.

Condition on Admission.—There was complete right-sided hemiplegia, with right facial paralysis, ptosis of right eyelid, and complete aphasia.

Operation.—On December 15th Civil Surgeon Perhouse deflected a large semi-circular flap, including both wounds, and exposed a deep gutter fracture connecting the apertures of entrance and exit. There was considerable fissuring of both tables on either side of fracture. The jagged edges of the gutter were excised, and the opening in skull enlarged with gouge forceps, after which a large number of splinters which had been driven into the brain and some pulpified brain substance and clots were removed. The apertures and scalp incision were dealt with and dressed as in the previous cases.

Subsequent Progress.—Three days after operation there was some improvement in patient's condition; defæcation and micturition were performed naturally, and motor power was gradually

returning, more markedly in the lower than in the upper limb; but there was no great improvement in the aphasic condition, speech being limited to the monosyllables "yes" and "no." The operation incision had united along the posterior two-thirds, but was still open in its anterior third, where the edges were somewhat puffy; there was no œdema of surrounding scalp; evening temperature was 99° F. On December 22nd, the date of patient's transfer to the base, his condition was much improved; there was almost complete return of motor power in the limbs, but the movements in both (especially in the upper) were somewhat ataxic; face still paralysed, and ptosis very marked; speech gradually returning, words such as "sir," "private," "Black Watch," &c., being articulated quite distinctly, but the longer words required a distinct effort, and were spurted out in an abrupt staccato manner; the unhealed portion of operation incision was granulating freely, and looked healthy.

Surgeon-General Charlton's report on this case, dated July 16th, 1900, was as follows: "Discharged as 'unfit'; detailed medical history says, 'he has now slight facial paralysis and marked aphasia; pupils unequal, considerable implication of sight, most marked in right eye; mental powers considerably implicated'; no mention of any hemiplegia."

Present Condition.—I saw this man on August 16th, 1904; his general appearance then was that of a man in perfect health, physique excellent, weight 12 stones. The aperture in skull caused by the fracture and enlarged at the operation has closed in very considerably, by what appears to be bony material, and is represented by an irregular, non-pulsating depression; no pain or tenderness over site of injury; no ptosis nor facial paralysis; hearing, taste and smell are normal; speech somewhat slow, but enunciation perfect, although he states that when agitated he stutters a little, especially over words beginning with the letter "s." He has never had any fits; motor system is normal; no wasting of muscles in either the upper or lower limbs, and the patellar reflex is normal. Except for an anæsthetic patch extending over the back of the right hand, from tip of index finger to lower end of radius, the sensory system is also normal. With regard to his eyesight, which was said to have been considerably implicated on his discharge from Netley, Dr. McGillivray, who examined him at the same time as R. D. (Case 2 above), writes: "The pupils are slightly smaller than normal, and react sluggishly to light and accommodation, and the right pupil is smaller than the left by half a millimetre. Lenses

and media are normal, but the optic discs look paler than normal. There is, however, no evidence of incipient atrophy, the vessels being normal both as regards size and relation to one another. Right vision, six-ninths partly, but with 1·75 D. cylinder axis ϕ 150°, it is normal. Left vision, six-ninths partly, but with 2 D. cylinder ϕ 40° it is normal. The fields of vision are normal both as regards form and colours, and the colour sense is normal both qualitatively and quantitatively." When leaving Orange River in December, 1899, this man gave me his home address as "Southesk Street, Brechin," but when examining him in Dundee, in August, 1904, I discovered that this was an address at which he lived during his childhood, and not the address of his parents in December, 1899, but it was the only one he could remember at the time.

CASE 5. *Glancing Fracture of Parietal, with Depression* (*Mauser*). —No. 4684 Private J. W. R., 1st Argyll and Sutherland Highlanders, aged 20 (enlisted as a boy), was admitted on December 13th, 1899. On examination a single wound, two and a half inches long, irregular in shape, and with lacerated edges, was detected a little behind and below the right parietal eminence. Brain substance protruded from the scalp wound, beneath which depressed bone could be distinctly felt.

Condition on Admission. — There was no paralysis; the only symptoms complained of were intense headache, some dimness of vision, thirst, and restlessness; patient was able to sit up, but on doing so felt weak and giddy. He would not at first consent to an operation, although the necessity for operative interference was fully explained to and urged upon him. The wound was thoroughly cleansed, and dressed antiseptically, an ice-bag applied to the forehead, bromide of potassium in full doses administered, and the patient made as comfortable as possible. This treatment was continued for five days, at the end of which time, the headache having increased in intensity, he consented to an operation, which was performed on December 19th.

Operation. — On deflecting a semi-circular flap embracing the wound, a piece of depressed bone, measuring one and a half by two inches, was found completely detached and pressing on the brain through the lacerated dura; there was some starring round the edges of the aperture in the skull, and two or three small fissures radiated therefrom. A small circle of bone having been trephined out of the postero-inferior angle of wound, the depressed fragment was elevated and removed, and several smaller, more deeply embedded fragments of the internal table brought away; one of these

was a very sharp-pointed spiculum, nearly an inch in length, lying apex upwards, at a depth of about an inch ; some disorganised brain substance and clots were removed, and the wound treated and dressed as in the cases described above. At 7 p.m., although the temperature had risen to 100° F., the headache was greatly relieved, and the patient expressed himself as " feeling much better."

Subsequent Progress. — Two days after operation patient was found sitting up, and reading in bed. The headache, which before the operation had been the most distressing symptom, had now quite gone, the temperature was normal, and he slept well. He was able to write quite clearly and distinctly; the dimness of vision had improved, and giddiness was relieved. On December 23rd patient was transferred to the base, where he subsequently underwent a second operation, and had some more fragments of bone removed from the brain, but made a good and rapid recovery, and was eventually invalided home. On July 16th, 1900, Surgeon-General Charlton (Netley), reported him as "discharged fit for duty ; wound healed ; no motor symptoms."

Present Condition.—On leaving Netley this man was sent to the depôt of his regiment at Stirling, where he did duty for some time, but was subsequently discharged as medically unfit for further service, and is now employed in the Ordnance Store at Stirling. I saw him on August 12th, 1904, when his condition was as follows : General health very good ; has never had any fits ; motor and sensory systems normal ; the cicatrix of wound, which is fully two inches in diameter, and soundly healed, is somewhat depressed, but there is no pulsation beneath it ; neither pain nor tenderness over wound, but he states that he occasionally suffers from very severe headache, and frequently from giddiness, which is aggravated on stooping and after exercise ; special senses normal, with the exception of eyesight ; the field of vision of left eye was apparently much contracted, but not having the means of making a thorough examination of his eyes, I sent him to Dr. Freeland Fergus, F.R.S.E. (Surgeon to the Glasgow Royal Eye Infirmary), to whom I am greatly indebted for the accompanying detailed ophthalmic report and tracings of fields of vision. Dr. Fergus writes : " I yesterday saw the patient R., and have to report on the condition of his eyes. Both eyes externally looked normal, and I found the reflexes of the pupils to light and to convergence as in health. The visual acuteness of the right eye, when uncorrected with glasses, is $\frac{1}{2}$ of Snellen's standard, and of the other $\frac{1}{3}$ of Snellen's standard, and this, notwithstanding the fact that he has approximately four dioptres of

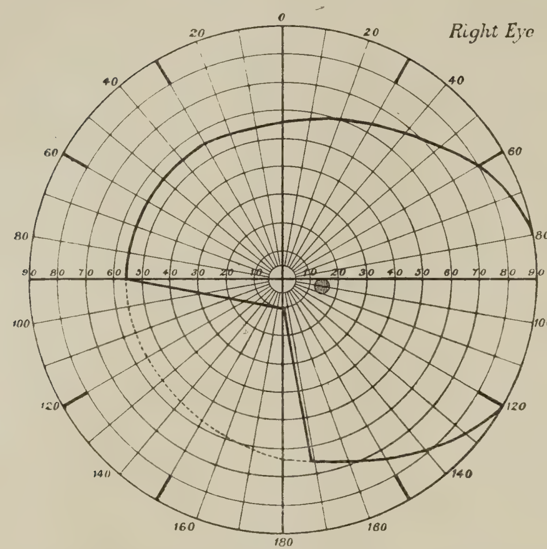


FIG. 3.—Right visual field, Case 5. Field for white. Good daylight.

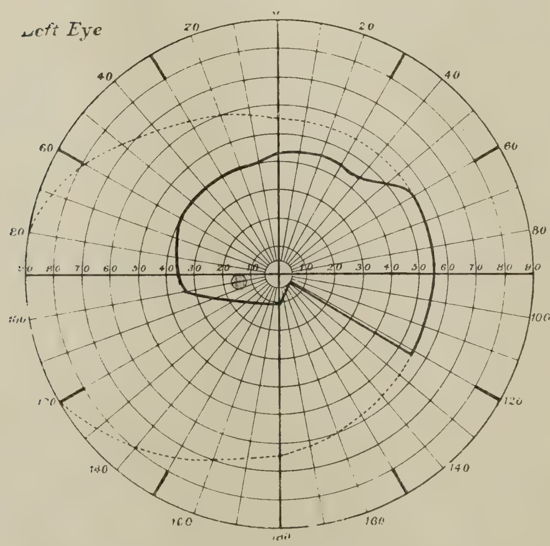


FIG. 4.—Left visual field in Case 5.

hypermetropia in each eye. With a partial correction he reads quite easily No. 1 Jaeger with each eye separately. The fields of vision were taken in good daylight for white, and herewith I enclose a copy of each field. That of the left eye, viz., the eye on the opposite side to the injury, is greatly restricted except at the nasal side of the field, that is to say, the centres corresponding to the nasal and upper parts of the retina are implicated. There is a slight defect in the field of vision of the right eye, which indicates that the temporal and upper parts of the centres corresponding with the temporal and upper aspects of the retina are implicated. I also ascertained the fact that in those parts of the field in which there is blindness for white light there is also blindness for colours. The optic nerves, as seen with the ophthalmoscope, looked perfectly healthy, and indeed, apart from the hypermetropia, the condition of the fundus of each eye calls for no special remark."

Case 6. *Gutter Fracture of Parietal* (*Mauser*).—No. 5400 Private G. H., 2nd Buffs Mounted Infantry, aged 21, service three years, was admitted on February 26th, 1900. This man was on his way from Modder River Hospital to the base, but the medical officer in charge of the train having reported that he was in a very debilitated state and had vomited several times on the journey, it was considered advisable to detrain him at Orange River. No previous operation had been performed. The wound of *entrance*, small and circular, was situated six inches above Reid's base line, and one and a half inches behind the left auditory meatus; that of *exit*, somewhat larger, oval in shape, with smooth edges, was situated one and a half inches behind that of entrance and half an inch nearer the middle line.

Condition on Admission.—Temperature 99° F., pulse 80, regular, and respirations normal. Beyond the vomiting already referred to, and slight headache, there were no cerebral symptoms; no aphasia; pupils normal, and responded sluggishly to light; there was paresis of right upper limb, with complete motor and sensory paralysis of the thenar group of muscles, the thumb being flexed and drawn into the palm; movements of whole limb ataxic, but pronation and supination of forearm were specially difficult.

Operation.—The day after admission, February 26th, a wide flap including both wounds was deflected, and a gutter fracture with very jagged edges, one and a half inches in length, and implicating both tables, was exposed. The width of the gutter, from which brain substance protruded, was no larger than the diameter of a Mauser bullet. On removing a disc of bone from the postero-

inferior angle of the gutter (fig. 5, C.), the dura was found discoloured and lacerated, but no depressed bone could be discovered. The aperture in skull was enlarged with gouge forceps, and the finger passed along the track through the rent in the dura, but no spicula could be detected; on withdrawing the finger, however, a small quantity of pus welled up from the track, which was then irrigated, and a second exploration made, when a sharp fragment, embedded at a depth of at least two inches in the brain, was detected and removed. This was found to consist of a piece of the entire thickness of the skull, and measured nearly an inch in its longest diameter (fig. 5, A); the inner table of this fragment was much fissured. Six smaller fragments (fig. 5, B, B.) were next removed,

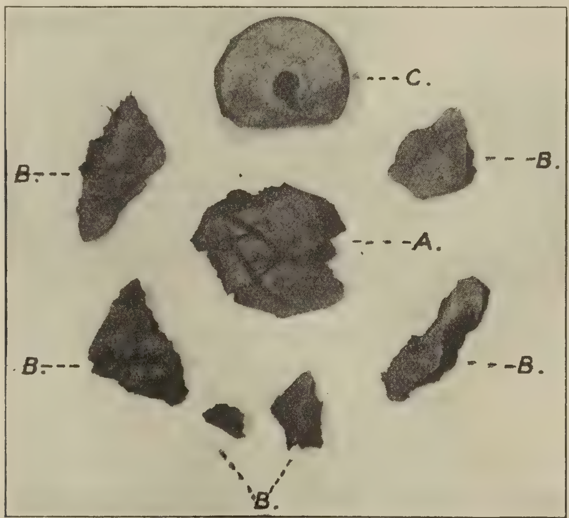


FIG. 5.—Showing disc of trephined bone (C), and fragments of bone (A, B, B, B), removed from skull of G. H. (Case 6). Natural size. The fragment A shows fissuring of inner table.

after which the margins of both scalp wounds were incised and sutured, the track gently irrigated, and the deflected scalp sutured into position along its anterior two-thirds, the posterior third being left open for drainage purposes. A cyanide dressing was applied.

Subsequent Progress.—The patient progressed favourably until March 2nd, when he complained of throbbing pain over site of injury, and had passed a restless night; the temperature had risen to 100·4° F. On removing the dressings a small quantity of pus exuded

from the exit wound, the margins of which were somewhat puffy. The operation incision appeared healthy, but one stitch was removed to relieve tension, and the wound opened up to this extent. The pus was found to be limited to the edges of the exit wound, which was cleaned, and the track between it and the reopened operation incision gently irrigated with perchloride solution (1 in 2,000), and a moist dressing of same applied. From this date the progress towards recovery was continuous and uninterrupted ; the wound was dressed daily for a few days, but by March 6th no drainage was required, a dry cyanide dressing was applied, and the patient was allowed up for a little, and placed on ordinary diet. By March 10th the wounds had quite healed, all stitches had been removed, and a cyanide gauze pad with capeline bandage constituted the sole dressing. Every movement of thumb, hand and forearm was perfect, and patient at his own request was allowed to help in the work of the ward. On March 21st he was transferred to the base in apparently perfect health, mental and physical. From the base he was invalided home, and eventually discharged from the service as medically unfit on September 1st, 1900. After leaving Orange River he underwent no further operation.

Present Condition.—I have not had an opportunity of seeing this man personally, but have to thank Dr. Prideaux Selby, of Teynham, Kent, for examining him, and furnishing me with the following account of his present condition. Dr. Selby writes: "The depressed scar on skull over area of operation is tender on pressure ; much stooping causes headache and throbbing in the wound ; motor and sensory systems are quite normal ; vision normal ; tongue protrudes in middle line ; no atrophy of right arm or leg. The only trouble which can be referred to the injury is that his memory of words is very imperfect, and he seems incapable of receiving and conveying a verbal message. It is only by *learning* a name that he can remember it ; unless he *learns* it the name is forgotten in a few minutes. In all other ways, physically and mentally, his condition may be regarded as normal. He makes an excellent chauffeur, and has thoroughly learnt to manage and keep in order my motor car."

CASE 7. *Gutter Fracture of Parietal* (*Shrapnel*).—Corporal G. M., of the Free States Artillery, a Boer prisoner of war, wounded at Cronje's laager, Paardeberg, on February 17th, 1900, was transferred from Jacobsdal to Modder River, and thence to the Cape Field Hospital at Orange River, where he remained until March 15th, when he was brought over to Detachment No. 5 General Hospital, for the purpose of being operated on. There was a single wound in the skull, one inch in length by half an inch

wide, situated five inches above and half an inch anterior to the right external auditory meatus. The wound, which was caused by a shrapnel bullet, was in a very septic condition, surrounded by flabby, exuberant granulations, and judging from the extremely dirty, matted condition of the surrounding hair, had evidently not been dressed nor attended to for several days. The uneven margin of the aperture in skull could be distinctly felt, and pointed to a depressed fracture.

Condition on Admission.—The patient was in a very anæmic and debilitated state ; there was considerable wasting of muscles of neck, shoulder, and upper limb on left side, with complete motor paralysis and wrist-drop ; the thenar eminence was almost completely obliterated, and the thumb flexed and drawn into the palm. Sensation was intact above, but considerably impaired below elbow. The left lower limb was also much wasted ; there was paresis of thigh muscles and complete motor paralysis of leg, with ankle-drop ; sensation of lower limb unimpaired, patellar reflex exaggerated, and marked ankle clonus. Immediately after admission the head was shaved, the scalp thoroughly cleansed, the wound gently irrigated, and boric fomentations applied.

Operation.—This was performed on the afternoon of the day of admission. A semi-circular flap, four inches from point to point, was deflected and a gutter fracture exposed, the edges of which were very rough and uneven, with slight radiation at its anterior angle. Pus was freely discharged from the lacerated brain substance, but no depressed bone could be seen ; on irrigating the wound, however, with a warm boric solution, some disorganised brain substance came away and exposed a piece of bone, the size of a threepenny piece, embedded at the posterior angle of the wound. This was removed with forceps, the edges of aperture enlarged, and a digital exploration made through the cranial opening thus enlarged. A number of comminuted bony fragments (sixteen in all), embedded in the brain at a depth of two inches, were removed *seriatim*, and when placed together covered an area one inch in diameter. The track was again irrigated and a large quantity of *débris*, including small particles of lead and grit, were washed away. The margins of the wound in the scalp having been incised the flap was sutured into position and a dry cyanide dressing applied.

Subsequent Progress.—On the evening of the day of operation the patient complained of slight headache and was very depressed ; he had vomited once or twice, but this was probably due to the effects of the anæsthetic, which he had taken badly ; temperature was only 99° F. All these symptoms passed off, and the patient did

well for the next few days, but on removing the dressing on March 18th a small quantity of pus oozed from the posterior angle of the bullet wound, and there was some œdema around corresponding portion of operation wound, one of the stitches from which was removed and the track between it and bullet wound thoroughly irrigated with a 1 in 2,000 perchloride solution, a strip of cyanide gauze passed into the track for drainage purposes and a moist cyanide dressing applied. This treatment was continued for the next twelve days, at the end of which time all discharge of pus had ceased, the anterior portion of operation incision had quite healed, the stitches having been removed some days previously, and the posterior portion, together with the bullet wound, was looking healthy and granulating freely. A dry dressing was now applied, the patient was placed on strychnine and arsenic, massage of muscles of neck, shoulder and limbs begun, and patient was carried out and placed in an easy chair for an hour every morning and evening. There was considerable improvement in motor power of both upper and lower limbs, the grasping power of hand and thumb was gradually returning, and hand could be raised to mouth; patellar tendon reflex still greatly exaggerated, ankle clonus marked; general health excellent. Three weeks later (April 23rd) the wound had healed completely, and all dressings were removed. He could now grasp very fairly with the left hand, but there was a good deal of tremulousness of thumb and fingers; he could also stand with help, and walk a little holding on to the bed, or supported by an orderly; the left leg was still ataxic, and the foot dragged considerably. A month later (May 20th) there was a marked improvement; he could use his hand quite freely, and grasping power was almost normal, he could also get about, with the aid of a stick, quite easily; the foot still dragged a little, but even here the improvement was very marked. The thenar eminence and supinator group of muscles in the upper limb, and the extensor muscles of leg were still much wasted, but were gradually gaining in tone.

On June 3rd the patient was transferred to the base, along with other prisoners of war. He was able to walk to the train (a distance of 200 yards) without any help, and carrying a small bundle of clothes. For some time previous to his transfer he had voluntarily helped the ward orderly in the lighter ward duties; he could now use his hand quite well, and the grasping power was practically normal, but he still dragged the left foot a little. Apart from this latter defect his general appearance was that of a man in robust health. I regret that I have been unable to trace this patient since his departure from Orange River.

Clinical Notes.

A RARE CASE OF FRACTURE OF THE HUMERUS.

By Captain F. J. PALMER.
Royal Army Medical Corps.

The following notes, from memory, of an exceedingly rare variety of fracture, may be of interest to some of the readers of this Journal:—

In August, 1903, I was called to see Major S., who had fallen about twenty minutes before, sustaining an injury of the right shoulder. On examination no perceptible alteration in the outline of the shoulder could be noticed, but the whole shoulder was, perhaps, a little swollen. The relation of all the bony parts was normal. Voluntary abduction was present to some extent, but caused great pain, which was also caused by pressure over the humeral head. On further examination a groove could be *distinctly* felt with the finger, running vertically downwards over the front of the humeral head for more than an inch. On pressing the finger into this groove, the outer edge of it seemed to be slightly movable, and intense pain was elicited. Bearing in mind the danger of breaking down any remaining attachment in cases of fracture about the humeral head, very little manipulation was attempted. Careful passive movement elicited an undoubted crepitus, felt by a finger of the left hand, in the groove. A careful consideration of the only signs present, viz., crepitus, and the presence of this groove, with apparent slight mobility of its edge, led to a diagnosis of fracture of the *great tuberosity of the humerus without rupture of the extension of the capsular ligament*, the fibres of which thus prevented displacement, as the only one which would fit all the facts of the case. The arm was put up temporarily in a right angled wooden splint, applied to the inside, supplemented with a shoulder cap of leather. A couple of days later, finding this splint rather uncomfortable, and bearing in mind the probable uselessness of a shoulder cap in such a case, a right-angled splint, made of perforated zinc, was carefully fashioned in such a manner that it was applied to the internal aspect of the arm and the under aspect of the forearm when the latter lay across the chest with the thumb upwards. This splint, well padded, proved exceedingly satisfactory, and gave great comfort to the patient. About the third day, at the anterior axillary fold and spread downwards along the inner aspect of the arm and upwards to the acromion and clavicle, the shoulder was greatly swollen, but was quickly reduced by surface massage. About the ninth day the patient proceeded to Bloemfontein, and a skiagram was

there taken, which showed a semilunar cap of bone, representing the great tuberosity completely separated from the upper end of the humerus by an interval of about a quarter of an inch. The fragment was in no way tilted, and completely bore out the diagnosis made. It is, I expect, still in Major S.'s possession. After his return from Bloemfontein passive motion was carefully commenced, and the range gradually increased. At the end of the third week the splint was dispensed with, and a sling substituted; movements in every direction, especially upwards, being continued. When last heard from, about six months after the accident, there was complete use of the arm, but, as was expected, the overhead motion was greatly restricted, presumably owing to the jamming of callus against the projecting acromion.

On reviewing the scanty literature upon this subject to which I have had access, I find that the case differs somewhat from some of those previously recorded, in several of which the diagnosis was only made *post mortem* years later. The injury is generally understood to be caused by *direct* injury to the shoulder, and Hamilton mentions two such cases, one of R. W. Smith's, and one of his own. In the present case the injury was plainly due to indirect violence, and most probably to muscular action. The dorsal surface of the second phalanges of the right hand were abraded, showing that the fall had taken place upon the more or less clenched hand. The fracture had apparently occurred through the powerful pull of the muscles attached to the great tuberosity in involuntary protective action. Gurlt reports a similar case of his own, in which he attributes the injury to muscular action, and Stimson, in the 1883 edition, describes a case of his own, which he believes was caused in a similar manner. In the latter case there was no displacement, owing, as he suggests, to persistence of periosteal or tendinous attachments. The signs of these cases were similar to the present case, but I should be inclined to lay more stress upon the groove, which was present in this case, as a diagnostic sign than upon any other, and its value in this connection has not previously been mentioned.

TWO CASES OF TRAUMATIC ANEURISM FROM GUNSHOT WOUNDS, TREATED IN A STATION HOSPITAL, SOUTH AFRICA. OPERATION. RECOVERY.

By Major J. BARNETT WILSON.
Royal Army Medical Corps.

Case I.—F. E., a Boer prisoner from Beyer's Commando, was admitted on March 19th, 1902, to No. 22 Stationary Hospital, Pietersburg. He had a large tumour in the upper part of the right thigh. He stated that this was the result of a bullet wound received at Mara,

in the Spelonken, five months previously. Two scars were visible. The one, which he said was caused by the entrance of the bullet, was on the outer part of the thigh, about 4 inches perpendicularly below the great trochanter. The other, somewhat larger, which he said was the exit wound, was on the inner aspect of the thigh at the junction of its upper and middle thirds. From the size of the scars it seemed that the wounds had been produced by the ordinary Lee-Metford bullet. The upper part of the thigh measured 26½ inches as compared with 21½ inches on the sound side. The patient stated that, at the time he was shot, the wounds had bled profusely, and that later his whole leg and foot had swollen very much. On admission he was, however, able to walk about, although I gathered that, from the time he was shot, he had done all his trekking with the commando in a waggon until the time he was taken prisoner and brought into my hospital. The tumour pulsated visibly and there was a very well-marked bruit on auscultation. A thrill could also be felt. There was no evidence of the vein being involved, and the superficial veins of the limb were not enlarged. The patient was a tall, powerful man, of very fine physique, and about 25 years of age. He had served in the Johannesburg Boer police. Owing to the enormous size and ill-defined walls of this aneurism, I did not think it advisable to cut down locally on it, as there was so much infiltration of the general tissues of the limb that the hæmorrhage would probably be severe before the injured ends of the vessel could be secured. Also, the proximity of the deep femoral and other large branches to the site of the injury would, I considered, very likely prevent the formation of an efficient clot. Scarpa's triangle was encroached on to such an extent by the tumour that it would have been impossible to tie the vessel there, even if it were desirable to do so. I therefore decided to tie the external iliac.

On May 28th the man was prepared for operation in the usual way. 1-500 periodide of mercury was used as the strong antiseptic solution, and 1-2000 as the weak (the periodide solutions were always used in my hospital for this purpose, owing to the many advantages they possess over the perchloride). On the 29th, the external iliac artery was ligatured by me by Cooper's modified method as described and figured in Sir F. Treves' larger work on "Operative Surgery." A stout, double catgut ligature was passed round the vessel, deep sutures were passed through the divided muscular structures and the wound closed by interrupted stitches. All pulsation in the aneurism had ceased; the limb was wrapped in blankets and kept warm by hot bottles. On June 8th, the wound was dressed and sutures removed. It was soundly healed. The aneurism was not much smaller, but there was no bruit or pulsation. Collateral circulation seemed perfect. June 26th, patient up and walking about. There is now a very fine bruit to be heard in the tumour, which could be stopped by grasping the abductor muscles, below the aneurism, so as to compress Hunter's canal. I could not make out if this slight bruit was caused by

blood returning into the aneurism from below, or by pressure by the tumour on the femoral vein. A few days after this the man was transferred to Pretoria. About a fortnight later this patient reappeared in Pietersburg, having obtained some employment. He came to see me, and said he was quite well and could walk eight or ten miles without inconvenience. September 20th, E. came to see me to-day in the uniform of the South African Constabulary. He looked very well. The aneurism is now considerably smaller, but the slight bruit is still there. It can be stopped as described above.

On February 21st, 1903, I heard from Major F. Porter, D.S.O., R.A.M.C., Principal Medical Officer, B. Division, South African Constabulary, that E. had again come into hospital, as his aneurism had begun to trouble him. Compression was tried and the tumour got smaller, but the bruit did not entirely cease. Eventually a second operation was undertaken, a large clot turned out, and both ends of the femoral artery tied. The man made a good recovery.

Note.—I think it is generally held that the proper treatment in these cases is to cut down on the aneurism, turn out clots, and secure the ends of the injured vessel at the seat of the injury. In the above case, however, all who saw the man agreed that to do so in the first instance would not have been advisable, owing to its great size, the volume of blood passing through it, and the matting of surrounding tissues, as well as the irregularity of its walls; the hæmorrhage would probably have been severe, if not fatal, before the ends could have been secured. I hoped that the first operation would effect a complete cure, but, failing that, that it would be largely diminishing the size of the aneurism, and the volume of blood passing through it render subsequent extirpation comparatively easy. I gather from Major Porter's letter that this is practically what happened. The man, when last I heard of him, was perfectly well.

Case II.—A Boer prisoner, F. G. J., from Beyer's Commando, was admitted to No. 22 Stationary Hospital, Pietersburg, on April 15th, 1902. He stated that he had been wounded by a Shrapnel bullet two months previously. There was a small scar on the outer side of the left leg, a little below and behind the head of the fibula. This, he stated, was the wound of entrance. There was a somewhat larger wound, situated about 2 inches above the inner malleolus of the tibia, half way between the posterior edge of the tibia and the posterior surface of the tendo Achillis. The wound was still open, slightly suppurating, with raised edges—in fact, it had the appearance of a sinus. The skin around was pigmented. On examination, a probe did not go far in any direction. The patient was extremely anæmic, with a sort of greenish pallor. This was said to be due to repeated attacks of malaria, contracted in the "low country" to the north of the Zoutspansberg, where the commando had spent a good deal of time. The wound was dressed, and the patient kept

in bed and put on quinine, and a good and abundant diet. On April 26th, ten days after admission, this patient got a rise of temperature and a rigor. The leg became swollen, hard, brawny and dusky-looking. It seemed as if cellulitis or erysipelas had set in. The patient was moved to a separate tent. Hot, moist antiseptic dressings under jaconet were used.

About May 5th, fluctuation was detected in this brawny swelling, at a point situated in the inner side of the leg, immediately behind the internal border of the tibia, at about the junction of its lower and middle thirds. An incision was made about 1 inch behind the inner margin of the tibia and parallel to it. A large quantity of pus with some sloughs and broken-down blood clot escaped. This was followed by sudden and most profuse arterial hæmorrhage. A tourniquet was applied, the incision enlarged, and all *débris*, as far as possible, cleared away. The tourniquet was then loosed, and the edges of the wound drawn apart to see where the hæmorrhage came from. No further hæmorrhage, however, took place, so the wound was packed with iodoform gauze and dressed. Slight hæmorrhage recurred on the 9th and on the 11th. On the 12th, the man having been previously prepared, was placed on the operating table. The original incision was extended 4 inches upwards parallel as before with the internal border of the tibia and about 1 inch behind it. The calf muscles were now found to be largely destroyed and replaced by sloughs. The incision was continued upwards in the same direction; the sloughing cavity was found to continue into the popliteal space. Just below this the cavity of a traumatic aneurism was found and a quantity of white and red blood-clot turned out. The cavity having now been cleared by irrigation of all clots and *débris*, the tourniquet which had been applied to the thigh before the operation was released. Profuse arterial hæmorrhage, in jets, occurred from two points in the aneurism wall. These points were evidently the ends of the divided posterior tibial artery. It had been injured close to its origin from the popliteal. With some difficulty these two ends were secured. The difficulty of the situation was rather enhanced by the fact that the silk ligatures employed snapped twice, perhaps from over-preparation. However, eventually the bleeding points were securely tied. It was now found that the posterior tibial artery had been injured just at its origin, and just below where the anterior tibial passed to the front of the leg between the bones through the aperture in the interosseus membrane. The operation was finished by clearing out all *débris* and clot, and packing the huge cavity with iodoform gauze. When completed it did not look an altogether promising case, as practically the whole of the calf muscle had been destroyed and the cavity was extremely septic.

The further history of the case was that, at first, very profuse and foul-smelling discharge occurred in the daily dressings. A counter-

opening was made for drainage above the outer malleolus. A secondary abscess on the inner side of the foot formed and was evacuated. Eventually, however, all this cleared up, leaving a healthy, granulating cavity, which gradually closed. The patient lost his anæmic look and melancholy aspect, improved in health, increased in weight, and became one of the cheeriest men in hospital. He got about on crutches and eventually with a stick, and when, on July 10th, he was transferred to Pretoria, we were quite sorry to lose him.

Note.—The case is interesting from the probable sequence of events which brought it about. Evidently a traumatic aneurism was formed at the time of the injury. The entrance wound apparently healed by first intention, thus shutting off risk of septic infection from above. Evidently the exit wound became infected some time subsequently to the formation of the aneurism, during his wanderings on the veldt. Septic infection must have travelled upwards, not giving rise to much disturbance at first, as the man's wound was painless, and almost free from discharge, and his temperature normal on first admission to hospital. Under the influence of septic infection, however, I imagine, eventually, the lower part of the aneurismal wall became disintegrated, probably a hæmorrhage took place into the substance of the limb, between and among the torn muscular structures, which might otherwise have reunited without much loss of substance. This probably occurred at the time when he had a rigor and rise of temperature, viz., on April 26th, or, in fact, coincidentally with the first indication of the mischief going on in the limb. Up to this date the limb appeared normal. There was no pain, discoloration or swelling, and the man's temperature was normal. There was nothing apparently wrong, except the small unhealed exit wound of the bullet, which had been slightly suppurating before his admission.

CASE OF RUPTURED BLADDER COMPLICATED BY ALCOHOLIC POISONING.

By Captain S. W. SWEETNAM and Lieutenant F. C. LAMBERT.
Royal Army Medical Corps.

Private X., of the Royal Field Artillery, aged 35, was brought up to the Station Hospital, Colchester, on a stretcher on the morning of August 9th, 1904, complaining that he was unable to get out of bed. He stated "that he had fallen down some stone stairs the night before, and that he had been drinking for the past week." The symptoms pointed to alcoholism, together with severe general bruising and a considerable amount of shock. There was some tenderness over the right lobe of the liver, and the skin was bruised down the right side. There was no

abdominal tenderness, neither were there any signs of free fluid or air in that cavity. There was, however, dulness in the right lumbar region. The patient frequently vomited bile-stained fluid, and the stomach was slightly dilated. He was said to have passed urine before he fell down the stairs. In the evening he developed marked nervous symptoms, and appeared to be on the verge of delirium tremens. He now complained of pain in the right lumbar region, where the dulness before noted had increased. As he had not passed urine during the day a No. 12 soft catheter was passed, and a large quantity of blood-stained urine drawn off, which relieved his lumbar pain. As the vomiting had not ceased, tinct. iodi. m. iii. was ordered, followed, a few hours later, by tinct. opii. m. xv. The next day patient's general condition had slightly improved, in spite of his not having had a good night. He still had marked tremor, and was restless. His pulse was irregular and just over 100. Temperature 99·8°. A catheter was again required, and the urine drawn off was still well mixed with blood. The following day, the third after admission, the man became very collapsed; his pulse was 120, irregular and feeble, he had an anxious, pinched expression, widely dilated pupils, tongue dry and brown. He vomited occasionally, and complained of pain in the epigastric region. His abdomen moved freely with respiration; was not tender nor distended. He had tenderness over the region of the right kidney, and there was still some dulness in the right lumbar region, but all other regions of the abdomen were resonant. His urine was less blood-stained, but had to be drawn off. A consultation was held as to the advisability of performing an exploratory operation, but was decided against, as, except for the lumbar dulness, there did not appear to be any definite signs of intra-abdominal injury, the remaining symptoms being thought to be due to alcohol, and the blood in the urine to a contusion of the right kidney. Towards the evening the patient became very restless, continually trying to get out of bed, and picking at the bed clothes, but the tremor, which had been so marked previously, had nearly ceased. In the afternoon he passed two ounces of urine, and stated that he had no pain. Trional gr. xxx. was ordered, and the hypodermic injection of strychnine, which had been given throughout the day, continued. His temperature now rose from 100·6° to 102°, and the heart-sounds became very feeble, the first sound being much shortened. The patient died at 1.15 a.m. The *post mortem* revealed an intraperitoneal rupture of the posterior surface of the bladder. There were numerous pockets of foul-smelling urine shut off by the matting together of intestines by recent lymph adhesions. The lower part of the right kidney was contused. The pericardium contained some turbid fluid, but the heart was normal.

We think that the chief points of interest about this case are: The absence of any local signs of peritonitis, as shown by rigidity, distension, &c., of the abdominal wall. The absence of any desire to micturate,

which is so usual in a case of ruptured bladder ; also that the patient only complained of pain in the epigastric and lumbar regions, instead of the hypogastric region ; also that the patient was able to pass two ounces of urine, without any pain, the third day after the injury was received. As to how much the patient's general condition was due to alcohol, how much to shock, the result of an injury, it was rather hard to determine, as his appearance and nervous symptoms were all in favour of commencing delirium tremens, as was also thought the inability to pass urine. The result of the *post mortem* points to an error of judgment in not having performed an exploratory operation when a correct diagnosis was a matter of considerable uncertainty.

Philosophy, Travel, &c.

RANIKHET AND THE DISTRICTS OF KUMAON AND GARHWAL.

By Lieutenant-Colonel C. E. NICHOL, D.S.O.
Royal Army Medical Corps.

(*Continued from page* 380.)

Bhim Tal, where lately they had a Boer camp, lies in a comparatively open valley, with a hill to the south of the lake, rising some 1,300 feet above its level. Further east in the same valley is Naukutchiya Tal, occupying a hollow in the slope. Sath Tal, or seven lakes, lies within a circle of hills between Bhim Tal and the valley of the Naini Tal river, and Malwa Tal lies to the north of Bhim Tal in a deep valley, the sides of which rise up abruptly from the level of the lake. The fishing in these lakes, I think, is frequently overrated. Naini Tal is not worth fishing, and Bhim Tal, especially of late years, has been greatly overfished, consequently the fish are exceedingly shy and wary. Boats are generally obtained at all the lakes. The best seasons are from end of March to end of May, and from middle of September to middle of October. The fish are mahseer, averaging about 2½ lbs., but run up to 5 lbs. Fly is the best bait, but they sometimes like a small spoon. The natives are very fond of fishing with paste made of "atta" or flour, but I have never seen them do much execution in this line. Excellent mahseer fishing to be got at the Sarjoo river, notably at Bageswar, twenty-six miles north of Almora. Here there is a good dak bungalow, with a resident "khansamah." The best fishing is three or four miles below the bungalow, and the mahseer run up to 40 lbs. and over. The best here is either live bait or a spoon, and best seasons end of May and beginning of October. There is still, even in these days of increased scarcity of game, very fair shooting to be got in the Ranikhet hills, but it is not too plentiful, and requires plenty of hard, honest work. Of course, the further afield one goes the better the bag, both for small and big game. Native "shikarries" still continue to effect a considerable destruction of the fast diminishing game, and we shall all welcome the, at present much talked of, game laws, if introduced by the Government o India, for the stricter preservation of the same. I give here a list

of the game birds and animals which are to be obtained in the districts of Kumaon and Garhwal, but though I shall offer some remarks on their general distribution, and where they can be got, it is not my intention to enter into any detailed description of the same. For this I shall refer my readers to such well known books as Baldwin's "Small and Big Game of Bengal," Kinloch's "Large Game Shooting in Thibet and Northern India," Hume and Marshall's "Game Birds of India, Burmah and Ceylon," Sterndale's "Mammalia of India," and the Badminton Library Volumes on "Big Game Shooting," all of which contain full and accurate information on the subject. I may also mention General McIntyre's "Hindu Koh," and Colonel Markham's "Himalayan Shooting" (the latter, I believe, is now nearly out of print), as being especially interesting with reference to "shikar" in the Himalayas.

(1) *The Moonal.*—This beautiful bird is rather scarce in Kumaon, but there are a few on Budkôt (9,000 feet), and facing Ranikhet. In the out-of-way spots in Garhwal, however, it is still plentiful and even abundant. Last winter, when Thar shooting in the higher ranges, at one place I used to see from twenty to thirty birds in the day, and what a glorious sight is an old cock moonal in full plumage as he comes hurtling down the hill-side in bright sunshine. No language can adequately describe his brilliant blue, green and purple metallic colouring—his beautiful bronze neck, white patch on back and chestnut tail. And what a thump he comes down, when you have held your powder straight. Ah! the intense delight of one's first moonal; it is almost equal to one's first tiger; or the first woodcock shot when a lad in the dear old home, 7,000 miles away; all red letter days to be treasured up in one's memory. The moonal for the table is a disappointing bird, and the old ones are only fit for making excellent soup.

(2) *The Cheer.*—This bird is nowhere plentiful, and never found in any numbers. They like long grass, situated below rocky precipices, and I have sometimes found them amongst big boulders and rocks. The Cheer of all the Himalayan pheasants most resembles the home bird, as he is the only one with a long tail. Last cold weather, when camped just outside the Gohna Lake, which was caused by the celebrated landslip in 1894, I went out for an afternoon's stroll with my wife, alas! without a gun: we had only gone a very short way from our tent when we heard something moving or scraping amongst the dead oak leaves. My spaniel at once darted in, and out came five Cheer, first an old cock, then two hens, and lastly a cock and hen, all affording easy shots. Such a chance at Cheer comes only once. I slept badly that night.

(3) *The Kalig.*—This is the common pheasant of the hills, and is fairly abundant everywhere. He does not give you very good sport—he always flies down the khud, or up into a tree, and is a great runner. You want to have thoroughly trained dogs to make a decent bag.

(4) *The Koklass.*—This bird, though found in parts of Kumaon, essentially belongs to the higher ranges. He is a real game bird, and flies at a tremendous pace, and wants first rate shooting to cut him down. He is an excellent bird for the table. His peculiar cry of "koklass-pucrass" is heard when one makes a start at dawn in every direction, but as daylight advances he ceases to call. I have never shot more than a brace at a time.

(5) *The Crimson Tragopan.*—This beautiful bird is very scarce and shy in its habits. Only once during my many wanderings have I come across it, though I have occasionally heard its call. I was stalking an old buck Thar at the time, and in passing through some heavy jungle I suddenly met one, but of course I had only a rifle in my hand and could not fire. He frequents the thick bamboo jungle in the upper ranges just below the snow line. It is called "Loongi" by the Garhwalis, and has a peculiar note, somewhat resembling the bleat of a goat, which can be heard at a great distance. The skin is much sought after, and still commands a good price in the London market.

(6) *The Snowcock.*—This is a bird entirely confined to the higher passes and Thibet. He is a heavily-built bird, more like a partridge than a pheasant, but a very strong flier. The first Snowcock I saw, or "huinwal," as the natives call him, reminded me of nothing so much as an enormous seagull.

(7) *The Black Partridge.*—This well-known bird, which affords one so much sport in the districts in the plains, where he is to be found, is nowhere plentiful in the hills, but is to be found throughout the Himalayas from the foot of the hills up to the top nearly of the snow passes. His well-known cry can also be heard a great distance off.

(8) *The Peurah Partridge.*—This little bird also is nowhere plentiful, but in certain spots numerous enough. He likes thick scrub thickets, high up, and not far from the forest. He is difficult to flush without a good dog. I know one particular spot in Garhwal where I can always pick up two or three brace of "jungli buter," as the natives call them. He is capital eating, and occasionally flies up into a tree. His call is a soft, though loud, whistle.

(9) *The Chukor.* — This grand bird, which almost exactly resembles in appearance the " Frenchman " of Norfolk and the Eastern counties, gives, *par excellence*, the best sport of any in the Himalayas. He frequents the sides of bare rocky hills, interspersed with bushes, and I am glad to say he is still to be found in good numbers in Ranikhet and neighbouring hills. He is the best bird of the lot for the table. Two sportsmen have just returned as I am writing this with the very respectable bag of nineteen brace. Those who have shot Chukor will know that this means a jolly long tramp and very straight shooting. You have got to be in first-rate condition to take a good bag of Chukor.

(10) *The Snow Partridge.*—This is a bird I have never shot, but he frequents the wildest spots amongst boulders, rocks, and crags, as the neighbourhood of the Niti pass, and is to be met with frequently on "burhel" ground.

(11) *The Woodcock.*—The very name of *Scolopax*, what memories does it not conjure up! Yes, exactly the same bird that one shot in the old spinney years ago, that we meet with once again in these hills. He generally puts in an appearance here about the end of October, but is nowhere present in numbers. Last winter, while camped at Ramneer, about seven marches from Ranikhet, I had the intense satisfaction of bagging three brace one morning in a snowstorm. The birds had apparently all been driven the previous night by the storm into a ditch of about 100 yards long. It was so cold I could hardly hold my gun, and am sorry to say I let two couple off. Ye Gods! fancy seeing ten woodcock in almost as many minutes. What would some of our crack sportsmen at home say to this?

(12) *The Himalayan Solitary Snipe.*—This is a decidedly rare bird, and I have only shot it on three occasions.

(13) *The Indian Hare* (*Lepus indicus*).—Though this animal extends through all the sub-mountain tracts up to 7,000 feet, and has been found on Budkôt (9,000); it is far from common, and I have not seen above a dozen shot, all told. It has occasionally been seen and shot on the Upat golf links.

(1) *The Tiger* (*Felis tigris*).—Though I have never had the luck to shoot a hill tiger I have had the opportunity of seeing some good skins. Those found well in the interior never leave the hills. They are bulkier animals than those of the Terai, and have longer and more furry hair, and shorter and thicker tails. I thought my chance had come last December. I was camping out in Garhwal

at about 9,000 feet, and one morning, very early, whilst looking for serow, we suddenly heard the sighing, bellowing noise made by a male tiger during the mating season. It is needless to say my "shikarri" and self (we were alone) nipped very expeditiously into the nearest respectable oak tree and waited events; but it was not to be; he passed above us about 70 yards off, and we only got a lightning glimpse. He went down an adjoining nullah, the intervening ridge between us completely shutting off our view. It was at this same place in the Sobha district three years ago that a tiger turned man-eater, and killed eight men before he was finally shot by two village "shikarries" over the eighth corpse by the aid of a lantern. They received a reward of 200 rupees from the Commissioner of the district.

(2) *The Panther.* — (3) *The Leopard.* — In differentiating the leopard and the panther as two different animals, I know many sportsman will not agree with me. It is possible so to arrange a series of skins, placing the larger varieties at one end and the smaller at the other, so that no one can say which of those in the middle is a panther and which a leopard. Still, it is difficult to believe the small, insignificant, round-headed little animal of about 5 feet 6 inches in length is the same animal as the handsome brute which runs to over 8 feet, and almost as bulky as a small tigress. Both varieties are common in these hills, though it is not by any means easy to bring them to bag. They are very fond of dogs, which they are constantly carrying off. I shot a very fine specimen, measuring 8½ feet when skinned, in my own garden, over a dog as bait; unfortunately he killed the dog with one blow before I could cover him. I wounded another sitting in a small detached building in the compound of the Station Hospital, also by moonlight, but unfortunately he got away, though we tracked him for a considerable distance. They are a regular pest in the hills and should be shot whenever possible. The larger variety has a well-marked ridge on the occipital bone, which is very rudimentary and almost absent in the smaller ones.

(4) *The Snow Leopard.*—One or two are generally to be found on the "burhel" ground about the Niti pass, but are not often bagged by sportsmen.

(5) *The Himalayan Black Bear* is common in these hills in certain years; in others it is very scarce. I have questioned many hill men regarding this fact, but have never received a satisfactory reply. He is an awkward customer when wounded at close quarters, and seems invariably to make for the face. Many of

the hill men are to be seen bearing frightful scars, the result of encounters with this animal, and, as a rule, they like to give him a wide berth.

(6) *The Wild Boar* is fairly numerous in the oak forest up to great elevations (10,000 feet) and they run very big there. They often inflict considerable damage to the crops, but are seldom shot.

(7) *The Gerow, or Sambhur.*—In these hills he is invariably called the Gerow, and, as a rule, has more massive and finer horns than those found in the Terai and Central India. He is to be obtained at no great distance from Ranikhet, but it is difficult to get a really good head, which is always a prize. The best I have shot measures 39½ inches, and is beautifully symmetrical and massive. He is a shy beast, and requires very careful stalking. October is the best month to go after him ; then his horns are out of velvet, and the fallen leaves in the forest are not dry enough to make the crackling noise they do later.

(8) *The Kakur* is still very plentiful all over Kumaon and Garhwal in suitable localities. He is excellent eating. His hoarse bark is constantly heard during the night and day, but he seldom ventures out in the open. I think the horns run bigger in the oak forests of the higher ranges, as compared with the pine forests of the middle zone. The best I have shot measure five inches (this is exclusive, of course, of the bony pedicle from which the horns spring, and which is covered with hair up to their base).

(9) *The Serow* is found in most of the rocky hill forests from 3,000 to 9,000 feet. He is a most common, ungainly looking animal, like a cross between a pig, a deer, and a goat. He frequents gloomy nullahs, with rank vegetation, always near water. He is generally alone, but I have seen a couple together. His horns run to ten or twelve inches. He is a savage beast, and a pet one kept by an Englishman, who lived in Garhwal, once attacked my " shikarri," knocked him over and inflicted a very severe wound in his loins, nearly piercing his kidney, and which laid him on his back for two months. I have heard of four being bagged in Ranikhet last season, but have been unlucky in my pursuit of this animal.

(10) *The Gooral.*—This animal is still very plentiful, and is to be got within easy reach of Ranikhet, and most of our other hill stations. They frequent the steep grassy slopes of the lower hills, and shooting them is certainly a fascinating sport, though not comparable to that of the Thar.

(11) *The Thar.*—Of all the animals which I have shot, I can safely say that the one which has given me most pleasure is a fine

old buck thar. This splendid wild goat, who stands about $3\frac{1}{2}$ feet high, is found throughout the Himalayas, just below the snow line, but not so high up as the burhel. If you are possessed of a firm foot and a good head, and do not mind risking your neck half a dozen times a day, then the pursuit of the thar is fascinating in the extreme. He requires very careful stalking, and the old ones

FIG. 3.—The Thar (*Hemitragus jemlaicus*).

frequent really villainous ground, as bad, every bit, as ibex ground. To successfully stalk an old thar, in the cold months when he has on his beautiful cape which hangs down to his knees and which he sheds during the summer months, I consider the acme of shooting. Whether it is the glorious air one breathes, the magnificent scenery all round, and the successful stalk accomplished, or all combined, one experiences on such occasions a strange sense of exhilaration and satisfaction. The thar is generally to be got at from 10,000 to 13,000 feet on the summits of the middle ranges in the banks of rocky ravines destitute of forest. The female and smaller buck are always to be found on easier ground. The best I have bagged

measured $12\frac{1}{2}$ inches, but the horns, which are trigonal in shape, are really the most insignificant feature of the animal. I used often to look at the picture in the Badminton Library volume, called "A Dream of Thar Shooting," and wonder if it was not grossly exaggerated. After spending a couple of months at the game, I came to the conclusion that it was not so far removed from the real thing. After all, if you do get into a really tight place, you can console yourself with these lines of that born sportsman Lindsay Gordon, whose short career came to such a tragic end :—

> " No game was ever yet worth a rap
> For a rational man to play,
> Into which no accident, no mishap
> Could possibly find its way."

(12) *The Burhel.*—This animal, which is a true sheep, inhabits the highest ranges, and will be found generally on the rich grassy slopes, watered by the melting snow. He is an exceptionally wide-awake gentleman, and will test your stalking powers to their utmost. A good head runs to 25 inches or more. Burhel will not be found below the large village of Malasi on the Niti route, and now-a-days one has to go further afield for a really good head.

(13) *The Musk Deer.*—This little animal, which possesses no horns in either sex, is found also in the higher ranges, from 8,000 feet up to the forest limit. It is ruthlessly pursued and snared by the hill-men for the sake of its musk pod, which contains the well-known perfume. Even the droppings of the male are strongly impregnated with this odour, a fact which I have verified, but never seen recorded in any sporting book. Curiously enough, the flesh, which is excellent eating, is never tainted in this way. It is a rare little animal, and I have only seen ten or twelve, and shot one, during my many wanderings in the hills. It used to be common in Kashmir, but now it is strictly preserved in that country. Only the full-grown male possesses the musk pod.

I have purposely omitted from the accompanying list the game found in the Terai, which forms the southern boundary of Kumaon ; but in that portion of it known as the Kumaon Terai, I have bagged at various times the following additional animals and birds. The cheetul (*Axis maculata*), the para or hog deer (*Axis porcunis*), the nilgai or blue bull (*Portax pectus*), the swamp deer or ghond (*Cervus duvancelli*), the wild cat (*Felis chans*), the Bengal florican (*Sypheotides bengalensis*), the kyah or swamp partridge (*Ortygonnis gularis*), the wood snipe (*Gallinajo nemoricola*), the red jungle fowl

(*Gallus ferrugineus*) and the common quail (*Coturnix communis*). Other mammals to be found in these hills are the Himalayan langoor and the Bengal monkey, the hill fox, the jackall (though plentiful round Ranikhet, he does not extend very far into Garhwal), the wild dog, the porcupine, and high up on the snow line, the marmot. In addition the pine marten is very common, and most destructive to small game ; he has a handsome fur, and generally two or three are found in company; on one occasion I saw five together. Another very interesting animal, which I never met with till last year, is the flying squirrel (*Pteromys petaurista*). He is found quite high up in the forests, about 8,000 feet, and is quite nocturnal in his habits. He is a curious animal, about three feet long, with a beautiful silky brown fur, and light coloured belly. They have a loose fold of fur stretching on each side from front to hind legs, which they spread out like a parachute and use as wings ; and they can fly about thirty yards in a slanting downward direction. They fly in this way : alight on a tree, run up it, and then fly downwards to an adjoining tree. I once shot fourteen of them by moonlight, and I fancy they were attracted from the surrounding forest by the light of my camp fire. Excepting another single specimen which I shot, this is the only occasion on which I have met them. They feed on the young shoots of trees, nuts and acorns.

Of snakes in these hills, Dr. Watson has collected twenty-three species, eight of which are venomous ; the latter includes *Babora russellii*, two of which were recently killed by my friend, Major T., on Budkôt, 9,000 feet, a hill due north of Ranikhet. The python is also to be met with, and I have heard of it at 8,000 feet in Garhwal.

Of birds, Jordon enumerates over two hundred species as found in these hills, and probably the number could be greatly increased. Many of the permanent residents, which summer in the higher ranges, are found in the winter months in the sheltered glens. It is in the upper forests of oak, birch, spruce, walnut and chestnut that we find feathered life most numerous. In and around Ranikhet they are not in great abundance, but the well-known notes of the Cuckoo (*Cuculus striatus*) are to be heard in the station during the hot months. He never calls in the rains and cold weather, and I do not know where he migrates to then. The Indian minivet (*Pericrocotus speciosus*), that brilliant little morsel of bright scarlet, with his orange-coloured mate, is to be seen flitting about the pines in the station in the winter months, and also various brightly-plumed members of the jay tribe. Higher up in Garhwal the tits, finches,

warblers, bulbuls, &c., are very numerous, and on one occasion I was delighted to recognise an old familiar friend, the missel-thrush.

Of *Lepidoptera* and *Coleoptera* there are great varieties and numbers, and I am sure there is here for any keen entomologist a wide field for observation and research. Many of the soldiers, and occasionally officers, of the garrison make beautiful collections of butterflies and moths during their sojourn here — perhaps not scientific collections, but still very pleasing to the eye.

Garhwal, of which such frequent allusion has been made, is the adjoining district, and is bounded on the north by Thibet, on the east by Kumaon, on the south by Bijnor, and on the west by Tirhi, or native Garhwal. It comprises an area of 5,500 square miles. It is essentially a land of mountain, dale and stream, and reminds one in parts of the wilder scenery of the Highlands; brawling streams and rushing torrents, and an Alpine climate, and the wonderful panorama of the eternal snows ever before one's eyes; what can one wish for more? The inhabitants are a sturdy, active race, chiefly engaged in agricultural pursuits, and are much superior to the lazy Kumaonis. You can always tell a Garhwali coolie from a Kumaoni one; the former invariably carries his load on his back by means of slings, as any sensible man would. The latter always places the burden on his head, supporting it by a bandage round his forehead. The Bhootiyas are another race quite distinct; they inhabit the districts adjoining Thibet already named, as well as the Niti and Milam valleys. There are several different clans of them, who do not intermarry. They are the great traders between Thibet and India, and though many of their habits resemble those of the Thibetans, with whom they have free intercourse, they still more closely resemble, in most of their customs, the inhabitants of Garhwal. When in Thibet they are to all intents and purposes orthodox Buddhists; when they come down this side they pay reverence to all the numerous hill deities and conform generally to the opinions of those whose company they are in. They speak a language of their own; though those who come down every year can talk Hindustani all right. They are fair, with a Mongolian caste of feature, are excessively dirty and never wash, thoroughly appreciate a joke and possess the fattest babies I have ever seen. They are always to be met with going backwards and forwards up to the passes with their flocks of laden goats and sheep. These wonderful little beasts carry salt, borax, and wool from Thibet down to the Indian plains, and return with the bartered articles, sugar, grain, tobacco, &c., every day, from October to April. Each

animal, according to its size, carries from 10 to 20 lbs. in two little bags across its pack-saddle. At the end of the day's march these are taken off and piled up in a neat heap and the goats turned out to graze; they are brought back in the evening and enclosed in a zareba of bushes and guarded from leopards and other wild animals by a powerful Thibetan dog, one or more of which accompany each flock; these dogs are great, hairy brutes, with bushy tails, pointed noses, and ears like a very big sheep dog, and similar in colour, and very savage. It is a curious sight to see the flocks meeting on a narrow path and going in opposite directions. They pass each other

Fig. 4.—The "traders" of the Himalayas.

without the slightest hesitation or confusion. The flock generally numbers from one to two hundred. These goats are, I understand, bred both in Kumaon and Thibet.

The inhabitants of Kumaon and Garhwal are Hindoos almost to a man, and in the latter district are many holy places, including the famous shrines of Badrinath and Kedarnath. The former is the head source of the Ganges in the group of lofty peaks known as Gangobri. The village where the temple is situated is 10,284 feet above sea level and 25 miles south of the Mana pass. The pilgrims yearly assemble at Hurdwar and proceed by Kedarnath and Badrinath

and home by Nandprayag and Karnprayag. The route is a long, difficult and tedious one, but the Hindoo is above all things a pious devotee, and no perils will put him off his journey. What recks he if he perish on the journey, falls into the swollen torrent, dies of hunger on the way, or is stricken down by cholera on the homeward journey? Nothing; he has been and washed away his sins in holy Gunga, where the sacred stream issues from its glacier source. Thousands flock here annually from all parts of India; many a time

Fig. 5.—Hindoo devotees *en route* to Badrinath.

have I watched them on the road, a motley crew of young and old, maimed and sick, strong and feeble, all travelling along these mountain paths. Many are clothed in rags, others, of the wealthier classes, are, with their women folk, being carried in "kiltas" and baskets on the backs of sturdy coolies. Surely a stranger sight cannot be witnessed anywhere.

There are several passes into Thibet, but the best known one on this side is the Niti, thirteen marches from Ranikhet. The pass is

at an elevation of 16,628 feet above the sea level and is open from the latter end of June till the second week of October. The best description of a visit to the Niti pass which I have read is that written by Batten, Commissioner of Kumaon from 1840 to 1850, and which is duly recorded in one of the old Government Gazetteers, but I cannot say in which volume. He graphically describes the intense suffering he went through from the rarity of the air at 17,000 feet, and how he was threatened with suffocation at almost every step he took whilst crossing the pass, and also the magnificent scenery he viewed from the various points in his eventful journey.

Note.—Authors consulted in the compilation of the above paper: Crooke's "North-West Province of India," Webber's "Forests of Upper India," Baldwin's "Small and Large Game of Bengal," and various Gazetteers and Blue Books of the United Provinces of Agra and Oudh.

RANIKHET, KUMAON.

6,069 Feet above Sea-Level. Latitude N. 29° 38′. Longitude E. 79° 29′.

	January	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Year
Monthly mean excess temperature of the solar thermometer above the maximum in shade	61·1	60·6	62·6	60·4	60·3	57·1	50·8	52·1	59·8	57·3	52·7	55·7	57·5
Monthly mean depression of the grass thermometer below the minimum in shade ..	14·5	13·6	13·9	13·3	12·0	9·0	5·3	6·0	8·9	13·5	17·2	19·1	12·2
Mean monthly and annual temperature ..	46·1	49·2	56·3	65·2	67·8	71·3	67·9	67·2	66·4	61·0	55.7	50·2	60·4
Mean diurnal and annual ranges of temperature	16·1	17·0	18·2	18·6	18·1	15·0	11·2	10·9	13·1	15·3	17·2	16·1	15·5
Monthly and annual means of pressure ..	24·096	24·076	24·070	24·066	24·010	23·932	23·926	23·959	24·023	24·106	24·157	24·134	24·046
Mean diurnal and annual ranges of pressure*	·068	·064	·056	·060	·056	·052	·052	·055	·058	·060	·057	·058	·055
Mean resultant wind directions	S. 81° W.	S. 54° W.	S. 57° W.	S. 63° W.	S. 63° W.	S. 75° W.	S. 77° W.	S. 72° W.	S. 61° W.	S. 63° W.	S. 56° W.	S. 60° W.	—
Monthly mean tension of aqueous vapour ..	·190	·203	·235	·264	·341	·472	·597	·593	·536	·334	·253	·199	·353
Approximate mean humidities	60	58	52	39	49	61	85	86	79	60	53	54	62
Average proportion of cloudy sky in tenths of the expanse	3·66	4·42	3·78	3·34	3·58	5·41	8·58	8·42	5·64	1·69	1·31	2·99	4·40
Rainfall	1·64	2·61	1·60	1·62	3·11	5·81	13·69	11·11	5·05	0·78	0·08	1·18	48·28

* Diurnal range, 10 a.m. to 4 p.m.

DISTRICTS OF KUMAON AND GARHWAL.

Small Game.

1.—The Moonal Pheasant (*Lophophorus impeyanus*).
2.—The Cheer Pheasant (*Phasianus wallichii*).
3.—The White-crested Kalig Pheasant (*Gallophasis albo-crestatus*).
4.—The Koklass Pheasant (*Pucrasia macrolopha*).
5.—The Crimson Tragopan, misnamed "The Argus" (*Ceriornis melanocephala*).
6.—The Snow Cock (*Tetrogallus himalayensis*).
7.—The Black Partridge (*Francolinus vulgaris*).
8.—The Black-throated, Hill, or Peurah Partridge (*Arboricola torgueola*).
9.—The Chukor (*Caccobis chukor*).
10.—The Snow Partridge (*Lerwa navicola*).
11.—The Woodcock (*Scolopax rusticola*).
12.—The Himalayan Solitary Snipe (*Gallinago solitaria*).
13.—The Indian Hare (*Lepus indicus*).

Big Game.

1.—The Tiger (*Felix tigris*).
2.—The Panther (*Felix pardus*).
3.—The Leopard (*Felix leopardus*).
4.—The Snow Leopard (*Felix uncia*). Garhwal only.
5.—The Himalayan Black Bear (*Ursus tibetanus*).
6.—The Wild Boar (*Sus indicus*).
7.—The Gerow or Sambhur (*Rusa aristotelis*).
8.—The Kakur, or Barking Deer (*Cervalus aureus*).
9.—The Serow (*Nemorrhœdus bubalina*).
10.—The Gooral (*Nemorrhœdus goral*).
11.—The Thar (*Hemitragus jemlaicus*).
12.—The Burhel (*Ovis nabura*).
13.—The Musk Deer (*Moschus moschiferus*). Garhwal only.

Reviews.

"The Practical Study of Malaria and other Blood Parasites," by J. W. W. Stephens, M.D.Cantab., D.P.H., Walter Myer Lecturer in Tropical Medicine, University of Liverpool, and S. R. Christophers, M.B.Vict., I.M.S., Members of the Royal Society's Commission on Malaria in Africa and India, 1898-1902.

The authors, in their preface to the second edition of this book, state: "Our aim in writing this book was, primarily, to assist the beginner who had little or no experience of the study of malaria, or kindred diseases of man and animals. While keeping this view steadily in mind, we by no means intended that its scope should be restricted solely to this, but endeavoured to make the book a convenient and complete reference book for those investigating blood parasites. Progress in the study of blood parasites is extremely rapid, and we have to add to this new edition, besides many new anophelines and mosquito genera and details of mosquito life, many new hæmogregarines, trypanosomata, &c., and an account of Schaudinn's remarkable investigations on halteridium. Two new additional chapters have also been added; one on the Leishman-Donovan bodies; a second on spirillar fever. The chapter on biting flies and fleas has been much expanded. In response to requests we have added four new coloured plates."

The study of blood parasites, as the authors state, has within recent years been rapidly pushed forward. The first effective stimulus which started this line of research, was given by the work of Bruce on Nagana and Tsetse-fly in Zululand in 1895. Since then the life history of Laveran's parasite of malaria, and other important problems in tropical medicine, have been worked out. Another important factor in the development of blood parasitology was the discovery of the well-known stain by Romanowsky.

The authors of this work have had an extensive field to traverse, and it may be said at once that they have fulfilled their task very well. Their special experience in the study of malaria in Africa and India on the Royal Society's Commission, enables them to speak with authority. The chapters on this subject are excellent. In Chapter xxvii., in the description of the Morbid Anatomy of Sleeping Sickness, the lesion most constantly present, viz., enlargement of the lymphatic glands, is omitted. Also, it is stated under the heading of Pathogenic Action of *Trypanosoma gambiense*, that the most convenient animal for experimental work is the guinea-pig. A reference to the reports of the Sleeping Sickness Commission in Uganda, will show that this animal proved refractory to this variety of trypanosome. Also, on p. 366, it is stated that "various other trypanosomes have been described in cattle, horses and camels, in Uganda," &c. Neither camels nor horses are found in Uganda.

The book can be confidently recommended to Officers of the Services engaged in the study of tropical diseases, and will form a valuable adjunct to their library.

E. D. W. Greig.

Current Literature.

Note on the Physical Development of the Japanese Soldier and the method of examining Recruits.—In the last volume, vol. vi., of the "*Mittheilungen aus der Medicinischen Fäcultät der Kaiserlich-Japanischen Universität,*" there is an article on the measurements of the Chinese soldier, in which the author incidentally tries to show that the Asiatic does not attain to mature growth any earlier than the European. In support of his contention he quotes the measurements made by the Medical Officers of the Japanese Army on a certain number of soldiers, with a view to observing their physical development year by year during the three years of service with the colours. The results were published in the Reports of the Japanese Army Medical Department ("*Rikugun-sho Tokei Nempo*") for 1900 and 1901. I have transcribed into English measurements the tables, given from the Japanese, in the article to which reference has just been made, and venture to submit them as being of considerable interest in affording some standard of comparison between the Japanese soldier's physique and that of soldiers of other nationalities.

The "Handbook of the Japanese Army" indicates the method by which the Japanese Army is recruited. Those who have drawn the number obliging them to serve with the colours are medically examined during the month of December in each year. The Tables appended show the results of examinations of a definite number of recruits at the time of enlistment, and of exactly similar measurements made in each succeeding December during their three years with the colours. The first examination is indicated in the Tables by the index number I., the second by the number II., the third by III., and the fourth by IV. The examinations were made at the same time of day, under the same conditions as regards food and clothing, and by the same methods. The measurements for height, weight, and chest expansion are made in the same way as in our Army, but the chest girth is the measurement made with the chest at rest, *i.e.*, a normal chest girth, neither fully inflated nor fully deflated. This measurement is made with a tape measure, placed exactly as in our method of measuring chest girth.

The reason why only a limited number of recruits was examined yearly for the purposes of these Tables is that the examinations are made very carefully and take much time. It would have been impossible, therefore, to carry out the examinations on the whole army. The annual examination of recruits is carried out by a board of two Army Medical Officers, assisted by two civil medical practitioners in each military district. The examinations must be continued daily from 8 a.m. till 4 p.m. until the annual levy have all been examined. There is a Regulation case of instruments for the purposes of this examination. The contents are :—

(1) A complete laryngoscopic outfit. (2) A complete outfit for examining the ear, including tuning fork, Pollitzer's bag, Eustachian catheter, &c. (3) Nose speculum. (4) Ophthalmoscope, lenses, atropine and dropper, Snellen's types in the form of various rectilinear figures, coloured threads and coloured plates. (5) Measure tapes. (6) Stethoscope. (7) Catheters. (8) Rectal speculum.

This list explains the nature of the examinations conducted by the Army Medical service in Japan. No microscopic examinations are undertaken nor is the urine examined.

The number of men examined each day does not exceed 200, the calculation being that only 180 to 190 can be properly examined in the time. In places where there are no dark rooms for the ophthalmoscopic examination, the eyes are examined at night. Recruits must have normal vision, but officers are not rejected because of myopia, and many wear spectacles.

1900

RECORD OF MEASUREMENTS OF SOLDIERS IN THE JAPANESE ARMY.

Branch of service	Number examined	Age		Average of the measurements				Index number of series of examinations
		Years	Months	Height	Weight	Chest girth	Chest expansion	
				Inches	lbs.	Inches	Inches	
Infantry ..	4,603	20	5	62·73	122·14	32·79	2·51	I.
		21	5	63·08	126·26	33·38	2·75	II.
		22	5	63·19	127·9	33·77	2·86	III.
		23	5	63·19	127·5	34·00	2·86	IV.
Cavalry ..	321	20	5	62·96	119·9	32·20	2·75	I.
		21	5	63·08	123·5	32·55	2·98	II.
		22	5	63·34	124·9	32·78	2·98	III.
		23	5	63·34	124·2	33·38	3·09	IV.
Field Artillery ..	513	20	6	65·37	131·8	33·65	2·62	I.
		21	6	65·37	136·3	34·33	2·98	II.
		22	6	65·48	137·8	34·34	2·98	III.
		23	6	65·59	136·3	34·57	3·09	IV.
Garrison Artillery ..	245	20	5	65·48	131·0	33·77	2·39	I.
		21	5	65·82	134·8	34·11	2·75	II.
		22	5	65·82	136·4	34·22	2·86	III.
		23	5	65·93	136·7	34·45	2·86	IV.
Pioneers ..	364	20	5	64·77	129·7	33·53	2·62	I.
		21	5	64·77	134·0	33·88	2·98	II.
		22	5	65·00	135·2	34·22	3·09	III.
		23	5	65·00	134·3	34·22	2·98	IV.
Railway Corps ..	16	20	5	65·37	132·5	33·77	2·27	I.
		21	5	65·48	136·0	34·22	2·86	II.
		22	5	65·59	141·2	34·22	2·86	III.
		23	5	65·59	143·7	35·40	2·86	IV.
Transport Corps ..	217	20	6	62·75	120·9	32·68	2·51	I.
		21	6	62·86	123·8	33·17	2·86	II.
		22	6	62·97	125·9	33·53	2·98	III.
		23	6	63·08	123·8	33·77	3·09	IV.
All troops ..	6,279	20	5	63·19	123·1	32·90	2·21	I.
		21	5	63·42	127·5	33·38	2·75	II.
		22	5	63·53	128·1	34·22	2·86	III.
		23	6	63·64	128·8	34·00	2·86	IV.

1901.

RECORD OF MEASUREMENTS OF SOLDIERS IN THE JAPANESE ARMY.

Branch of service	Number examined	Index number of examination	Age		Average of the measurements			
			Years	Months	Height	Weight	Chest girth	Chest expansion
					Inches	lbs.	Inches	Inches
Infantry ..	5,250	I.	20	6	62·73	122·7	32·90	2·51
		II.	21	6	62·84	126·9	33·53	2·62
		III.	22	6	62·95	128·4	33·77	8·86
		IV.	23	6	62·95	126·6	33·77	2·86
Cavalry ..	316	I.	20	5	63·19	119·1	32·44	2·73
		II.	21	5	63·19	123·5	33·01	2·97
		III.	22	5	63·19	125·3	33·27	2·97
		IV.	23	5	63·20	124·2	33·27	2·97
Field Artillery ..	854	I.	20	6	65·11	132·2	33·64	2·73
		II.	21	6	65·37	135·7	33·77	2·86
		III.	22	6	65·37	136·0	34·11	2·86
		IV.	23	6	65·48	135·5	34·22	2·86
Garrison Artillery ..	459	I.	20	6	65·59	131·2	33·77	2·62
		II.	21	6	65·70	136·8	34·57	2·86
		III.	22	6	65·82	136·7	34·68	2·97
		IV.	23	6	65·82	134·8	34·68	2·97
Pioneers ..	441	I.	20	6	64·66	127·5	33·27	2·73
		II.	21	6	64·77	133·7	34·11	2·86
		III.	22	6	64·77	134·2	34·11	2·97
		IV.	23	6	64·88	131·0	34·22	2·97
Railway Corps ..	33	I.	20	6	65·11	130·4	33·53	2·62
		II.	21	6	65·37	136·1	34·11	2·86
		III.	22	6	65·37	139·5	34·45	2·78
		IV.	23	6	65·37	140·7	34·45	2·73
Transport Corps ..	227	I.	20	5	62·73	121·0	32·44	2·62
		II.	21	5	62·84	125·6	33·38	2·73
		III.	22	5	62·95	126·3	33·64	2·86
		IV.	23	5	63·08	125·3	33·38	2·97
All troops ..	7,380	I.	20	6	64·12	126·2	33·12	2·62
		II.	21	6	64·23	131·3	33·77	2·86
		III.	22	6	64·34	132·5	34·00	2·86
		IV.	23	6	64·34	131·1	34·00	2·86

Pathological Anatomy, its place in Medicine, and how it should be Taught. By Professor Orth, of Berlin.—This address was delivered in December last, at the Festival of the Foundation of the Kaiser Wilhelm's Academy of Military Medicine. It constitutes an earnest plea for the recognition of the claims of pathological anatomy as a branch of medical science. Professor Orth is well qualified for the task he undertook. Thirty years had passed since, as first assistant to the late Professor Virchow, he was installed as a teacher of the subject at the same institution. He is now Virchow's successor as professor of pathology.

After giving a short sketch of the development of pathological anatomy, he claims that by insisting on the value of the observation of facts, it rescued medicine from the condition into which it had fallen when physicians were labouring to discover a physical vital force which could be co-ordinated with electricity or magnetism. As the causes of clinical symptoms were unveiled, medicine was supplied with bases for diagnosis

and treatment. But the valuation of pathological anatomy became excessive; Rokitansky regarded the new science as all-sufficient. But Virchow held a different view, viz., that a science dealing only with dead material could by itself yield no satisfactory conclusions as to the condition of the living. One more aid at least was wanting, viz., pathological physiology, regarded by Virchow as the final object of scientific medicine.

Orth emphasises the importance of examining the whole body, and not only the parts primarily diseased. The introduction of the more scientific plan is largely due to Virchow, who wrote as follows in 1859: "We can further, in the most essential manner, the advance of medical science by adopting the habit of minutely examining all the organs of the body, and not only those in which disease was recognised during life." Great care is necessary, for the anatomical examination must be completed once for all, and does not admit of repetition; whereas we can, at the bedside, generally return again and again to the same case, and remedy any omission.

Classification of diseases based on their causes is the best that could be formed, and pathological anatomy has been decried because it has not materially assisted either ætiology or therapeutics. But with regard to the former, the charge is not true; in very many cases, pathological anatomy reveals so clearly the causes of the symptoms, that in other cases the physician is enabled, during life, to estimate the nature and extent of the changes. As regards therapeutics, it is only necessary to allude to the removal of tumours from the spinal cord, and to modern surgical operations on the brain, kidney, stomach and intestines. The success of these procedures depends largely upon pathological anatomy. In medico-legal inquiries, the same science is all-important; and the necessity of making a thorough examination is very evident.

The merits and importance of medical bacteriology have been regarded as far surpassing those of pathological anatomy. But the former is really a development and branch of the latter.

With regard to therapeutics, it should be observed that ætiology and treatment are not so inseparably connected as some imagine. It is doubtless of extreme importance to know the real cause of a malady so as to be able to attack it at its root, but even when the latter is unknown, treatment is not always futile.

There are other advantages connected with the study of pathological anatomy. Without reference to it, there can be no real clinical instruction. Moreover, its study offers a field for the cultivation of scientific work, observation and thought.

In conclusion, Professor Orth describes his system of teaching. He gives lectures on special pathology in the long winter session, and on general pathology in the summer. He emphasises the advantages of seeing examples of disease as compared with hearing and reading about them. Pathological anatomy cannot be learnt from books or lectures; that which a man has not seen in his student-days is lost.

T. P. Smith.

Action of Arsenic and Trypanroth on Trypanosoma Gambiense.—Laveran, in a note, *Comptes rendus des séances de l'Academie des Sciences*, cxiv. p. 287 (*Séance du* 30 *Janvier*, 1905), records the results of his observations on the action of arsenic and trypanroth on the *Trypanosoma*

gambiense in rats and dogs. Similar observations are being made by the Sleeping Sickness Commission of the Royal Society in Uganda on man and animals. The results so far obtained are similar to those recorded by Laveran.

The method which Laveran adopts for the administration of the drugs is to inject the animal infected with *T. gambiense* with arsenious acid, and forty-eight hours after with trypanroth. For white rats he considers that treatment on the above lines carried out on three occasions at intervals of eight days is generally sufficient. Two rats infected with *T. gambiense* on October 17th, 1904, and treated with arsenic and trypanroth, are, in Laveran's opinion, now cured, the trypanosomes having been absent from the blood for ninety-one days. For dogs he considers that a dose of 1·5 mgm. of arsenic per kilo. of dog ought not to be exceeded. For a dog of 10 to 12 kilos., 14 to 16 mgms. is a suitable dose. A dog 10 to 12 kilos. stands well a dose of 30 to 40 centigrammes of trypanroth.

Professor P. Ehrlich is investigating the subject further and has obtained another substance similar to trypanroth. The power of these bodies to destroy the *T. gambiense* in the tissues of man has and is being tested by the Sleeping Sickness Commission in Uganda. Could a substance or combination of substances capable of effecting this be found, the problem of dealing with sleeping sickness would be solved. Accordingly, the results of the experiments in this direction now being conducted by Gray and Tulloch in Uganda, will be looked forward to with much interest.

E. D. W. Greig.

Correspondence.

SPITTING SNAKES.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

Dear Sir,—I have read Colonel Bartlett's and Captain Hardy's remarks *re* spitting snakes with much interest, as when I was Medical Officer in charge of the 1st Battalion Connaught Rangers in South Africa in 1900, a curious case came to my notice, as follows: On March 3rd, 1900, Private Brady, 1st Connaught Rangers, was led up to my tent at about noon, reporting sick. The Irish Brigade was then at Thornhill Camp, outside Ladysmith. On examination the man was suffering from acute conjunctivitis, with intense pain and photophobia of both eyes. His explanation of the cause was, "Shure, your honour dochther, a snake has spat in me eye." The men who were with him stated that Private Brady had seen a snake on an adjacent kopje, and had struck at the animal with a short stick which he was carrying in his hand at the time. The blow failed to harm the snake, which spat at Private Brady. They had then succeeded in killing the animal, which was subsequently brought to my tent. The Regimental Transport Conductor, a South African Colonial, immediately pronounced the snake to be a "spuw slang," and informed me that the Zulus called it "umfezi." In appearance it was a dull brown snake with a flat head, blunt stumpy tail, belly yellow, with a salmon pinkish tinge, and about 30 inches in length. The head had been so battered in and crushed, that all I could make out were poison glands with apparently no striking fangs.

Doctor Ramsay, a Civil Surgeon, whom I subsequently met in Bloemfontein, told me that such snakes were often seen in Central Africa, and that he himself had been struck on the cheek by the fluid ejected by such an animal, which had caused intense local pain and swelling for some days. Private Brady was completely blind for three days, and his eye affection was similar to an attack of ophthalmia.

I am, &c.,

Sialkot, Punjab, India. R. W. Fuhr.
January 24th, 1905. *Captain R.A.M.C.*

JOURNAL

OF THE

ROYAL ARMY MEDICAL CORPS.

Corps News.

APRIL, 1905.

GAZETTE NOTIFICATIONS.—ROYAL ARMY MEDICAL CORPS.

Lieutenant-Colonel J. Magill, M.D., C.B., to be Colonel, vice A. H. Anthonisz, retired, dated December 22, 1904.

Lieutenant-Colonel H. R. Whitehead, F.R.C.S.Eng., to be Colonel, vice J. M. Beamish, retired, dated January 26, 1905.

The undermentioned Lieutenants are confirmed in that rank: D. D. Paton, M.B., J. A. Longley, M.B., N. E. Dunkerton, S. C. Bowle, G. S. C. Hayes, C. Ryley, P. Dwyer, M.B., P. C. T. Davy, M.B., W. H. Hills, M.B., J. F. C. Mackenzie, M.B., H. T. Wilson, R. C. Hallowes, M.B., J. Campbell, M.B., G. A. D. Harvey, H. C. Winckworth, H. W. Russell, M.B., E. J. H. Luxmoore, H. C. Sidgwick, M.B., M. Sinclair, M.B., G. R. Painton, N. Low, A. H. Fraser, M.B., R. H. L. Cordner, A. T. Frost, M.B., K. A. C. Doig, P. A. Jones, H. O. M. Beadnell, C. R. Millar, G. H. Richards, J. St. A. Maughan.

The undermentioned gentlemen to be Lieutenants on probation, dated January 31, 1905: Charles Pinkerton Thomson, M.D., George Wykeham Heron, Robert John Bertram Buchanan, George Brooke Forbes Churchill, William Steward Nealor, James Edward Hoar, Richard Graves Meredith, M.B., Frederick Emilius Roberts, George Smith Wallace, M.B., Wilfred Parsons, Arthur Anderson McNeight, M.B., Ernest Brabazon Booth, M.D., Thomas Holroyd Gibbon, M.D., Richard James Campbell Thompson, Ernest George Robert Lithgow, Pierce Power, M.B., Charles William O'Brien, Ryder Percival Nash, James Sydney Pascoe, Cecil Dacre More Holbrooke, John Maurice Bisdie Rahilly, M.B., George Grant Tabuteau, Richard Edmond Humfrey, William George Maydon, M.B., Garfield Ormrod, M.B.

The undermentioned Lieutenants are seconded under the provisions of Article 349, Royal Warrant for Pay and Promotion, October 26, 1900. Dated January 31, 1905: G. W. Heron, J. M. B. Rahilly, M.B., R. J. C. Thompson.

The undermentioned Majors to be Lieutenant-Colonels, dated January 31, 1905: J. R. Forrest, Brevet Lieutenant-Colonel M. W. Russell, G. E. Moffet, M.B., H. A. Haines, M.D., G. E. Hale, D.S.O., C. W. Johnson, M.B., A. T. I. Lilly, C. C. Reilly, A. de C. Scanlan, W. Turner, W. E. Berryman, S. E. Duncan, R. Caldwell.

The undermentioned Majors are placed on retired pay, dated January 31, 1905: B. F. Zimmermann, A. Stables, M.B., J. D. Moir, M.B., R. Crofts, D.S.O., H. D. James, G. M. Dobson, M.B. These officers entered the Service January 31, 1885.

Lieutenant S. M. Adye-Curran to be Captain, dated November 28, 1904.

Lieutenant G. F. Rugg is seconded for service with the Egyptian Army, dated February 10, 1905.

Lieutenant-Colonel G. F. A. Smythe, F.R.C.S.Edin., retires on retired pay, dated March 11, 1905. He entered the Service March 6, 1880, was promoted Surgeon-Major March 6, 1892, and Lieutenant-Colonel March 6, 1900. His war services are as follows: Nile Expedition, 1898. Battle of Khartoum. Despatches, *London Gazette*, September 30, 1898. Egyptian Medal with clasp. Medal.

Major F. J. W. Porter, D.S.O., from the Seconded List, to be Major, dated March 1, 1905.

Major R. H. Penton, D.S.O., from the Seconded List, to be Major, dated March 1, 1905.

March 5; 17389 Private A. Parkes, March 7; 11721 Private A. E. Russell, March 6; 17372 Private W. J. Norris, March 8.

Transfers to other Corps.—19122 Private F. G. Lock to Army Service Corps, February 6.

Deaths.—5930 Private W. W. Bardwell, at Queenstown, March 3, from pneumonia.

NOTES FROM THE DEVONPORT DISTRICT.—Major C. J. W. Tatham, R.A.M.C., writes: "A meeting of the R.A.M.C. Medical Society was held in the Officers' Library on February 28, Colonel G. D. Bourke, R.A.M.C., P.M.O., Devonport District, in the chair. Captain F. F. Carroll showed a case of Actinomycosis, and read brief notes. Major Ievers, R.A.M.C. (retired pay), mentioned a case of chronic abscess of the neck in which, on incision, he found a grain, probably wheat or barley, covered by a green substance. On removal the abscess healed quickly. Captain W. P. Gwynn read a paper describing the sanatorium treatment for cases of phthisis.

"The Football Club of No. 7 Company, R.A.M.C., is in a flourishing condition. Under the auspices of the Devon Wednesday League (Association), in which it is enrolled, a number of matches have been played. Unavoidable changes in the team have rather weakened it, and the record so far is not so good as could have been wished. Nineteen matches have been played, of which six have been won, twelve lost and one drawn. Recent successes have been obtained over No. 38 Company, R.G.A., and the A.S.C."

NOTES FROM SALISBURY PLAIN DISTRICT.—Under the new distribution scheme the following stations have been added to this district: Birmingham, Coventry, Warwick, Oxford, Devizes and Trowbridge.

Surgeon-General W. Donovan has been succeeded as Administrative Medical Officer of the District by Colonel W. Allan May, C.B., from Egypt. Lieutenant-Colonel C. E. Faunce has embarked for India, and handed over command of the Military Hospital and 20th Company R.A.M.C., at Bulford, to Lieutenant-Colonel H. K. Allport, from Maidstone. Major A. F. Tyrrell has embarked for Gibraltar, and Captain C. M. Fleury for Malta. Captain Robert J. Blackham, specialist in gynæcology, has been appointed to the charge of officers' and soldiers' wives and families at Bulford, vice Civil Surgeon Lockyer, whose period of service with the War Department has expired. Captain R. L. Argles has reported his arrival from West Coast leave, and Captain H. F. Shea from a tour of service in Mauritius. Captain C. W. Mainprise arrived from service in India on March 10, and will be posted to Tidworth for duty.

NOTES FROM CAIRO, EGYPT.—On February 16 the Royal Army Medical Corps mustered in force at the Military Chapel, Kasr-el-Nil Barracks, Cairo, on the occasion of the marriage of Major J. D. F. Donegan, R.A.M.C., to Miss Amy Sutton, youngest daughter of the late R. A. Sutton and Mrs. Sutton, of Rose Lodge, Blackrock, co. Cork, Ireland. The wedding was purely military, and the varied uniforms of the different corps and regiments added to its picturesque appearance. The Rev. Edward Ryan, Senior Chaplain to the Forces, performed the ceremony, and under his supervision the chapel was charmingly decorated with flowers. Captain Wilson, R.A.M.C., placed his motor car at the disposal of the bridal party, and drove the bride, accompanied by her brother-in-law, Captain Charles Lynch, M.F.H., 4th Scottish Rifles, to the church. Captain C. K. Morgan, R.A.M.C., acted as best man, and Miss Wintie Hardy, aged 5, daughter of Major Hardy, R.A.M.C., and Mrs. Hardy, appeared as bridesmaid. After the wedding the guests proceeded to Edward House, the residence of Major and Mrs. Hardy, where the health of the bride and bridegroom was proposed by Lieutenant-Colonel O. Todd, Acting Principal Medical Officer, Army of Occupation. The presents were particularly handsome and numerous.

NOTES FROM CEYLON.—Lieutenant-Colonel R. D. Hodson, R.A.M.C., writes that the following officer, non-commissioned officers and men left by the H. T. "Dilwara" on January 2, 1905, for England, tour expired: Captain P. J. Bodington, R.A.M.C.; Staff-Sergeant A. G. Powell; Corporals T. Scruby and A. Spalding; Privates A. Ford, S. Neill, B. W. Rees, W. Sawers, H. Rice and J. M. Morissy. Major F. W. Begbie, R.A.M.C., left for England per s.s. "Derbyshire" on February 7, 1905, at the recommendation of a Medical Board. He was suffering from debility after enteric fever, which he contracted while on leave shooting in the Jungle. This officer was also tour expired, but not able to proceed on January 2, 1905.

"Staff-Sergeant A. P. Barnard, R.A.M.C., has passed his professional examination for promotion to Quartermaster-Sergeant. This non-commissioned officer embarked

on February 16, 1905, on board the P. and O. s.s. 'Oroya' for passage to England, tour expired."

NOTES FROM SIERRA LEONE.—Lieutenant-Colonel C. R. Bartlett and Captain J. C. Prittie Perry, R.A.M.C., write: "Major F. Smith, D.S.O., Special Sanitary Officer, has gone home, tour expired, after a year's hard work in the Colony on original research, and has been relieved by Captain Grattan, R.A.M.C. Major Smith had the misfortune to temporarily lose all his notes through a thief carrying off one of his boxes, in which they were stored, and just on the eve of his departure, too. We congratulate him on their recovery, and hope before long to be in possession, through the medium of our valuable Journal, of the fruits of his labour.

"Captain Taylor, R.A.M.C., and Mrs. Taylor have gone to the Islands to recruit after a sharp attack of fever. General regret and sympathy is expressed on all sides at the loss of their child. Captain Taylor's place at Tower Hill has been taken by Captain J. V. Forrest, and in consequence Major J. S. McLoughlin has had to do all the work at Mount Auriol at a time when there was much sickness at that station.

"A Major in the West India Regiment is just recovering from an attack of blackwater fever, while a Captain in the same regiment has just returned from the Islands, having recruited after a similar illness.

"This is the dry season now, and the Harmattan wind, which comes from the Sahara charged with minute particles of sand, renders the air fairly cool, but the foreign particles it contains are the means of causing sore throats, of which most of the white population seem to be complaining.

"There is great excitement at present over the possibility of an expedition being sent against the Kissys on the borders of Liberia, but the general opinion of those qualified to speak on the subject is that it is only one of many false alarms that take place annually from the same district.

"The 46th Company Royal Garrison Artillery, who have been detained in this station two or three months over their time, and have suffered severely from fever during the last month, left for England yesterday, and the number of men in hospital has been reduced in one week from fifty-six to thirty. In consequence the pressure of work at Mount Auriol has been relieved."

NOTES FROM SIMLA, INDIA.—Captain E. Blake Knox, R.A.M.C., notifies the following appointments: "Captain A. E. Milner, R.A.M.C., to be Staff Officer, Army Bearer Corps, Secunderabad division, vice Lieutenant-Colonel O. E. P. Lloyd, V.C., R.A.M.C., resigned the appointment, with effect from December 31, 1904. The following officers have been appointed specialists in the subjects noted against their names, with effect from the date of their arrival in their commands: Major J. W. Jennings, Skiagraphy, Eastern Command; Major T. McDermott, Ophthalmology, Eastern Command; Captain W. E. Hudlestone, Specific Fevers, Western Command; Captain J. G. Berne, Otology, Western Command; Major C. H. Melville to be Sanitary Officer, Army Headquarters, vice Lieutenant-Colonel H. S. McGill, tour expired; Major G. Raymond to be Sanitary Officer, Secunderabad and Burma Divisions, vice Major C. H. Melville, appointed Sanitary Officer, Army Headquarters. Lieutenant-Colonel H. S. McGill embarks for England on or about March 22, vice Lieutenant-Colonel Lambkin, tour expired, who is on leave."

QUEEN ALEXANDRA'S IMPERIAL MILITARY NURSING SERVICE:—

Appointments.—As Staff Nurses: Miss M. J. Hepple, Miss M. B. Williams, Miss E. K. Kaberry, Miss C. G. Lees, Miss M. L. Macartney, Miss S. Richards.

Miss E. M. Lang has been posted to the Station Hospital, Lincoln, for temporary duty.

Resignations.—The following Sisters have resigned their appointments on their marriage: Miss D. V. Briscoe and Miss D. I. Rickards.

Changes of Station.—Sisters: Miss A. Guthrie, to South Africa, from Guards' Hospital, London; Miss W. Potter, to Royal Infirmary, Dublin, from Royal Herbert Hospital, Woolwich; Miss M. L. Potter, to Royal Herbert Hospital, Woolwich, from Royal Infirmary, Dublin, in exchange with Miss W. Potter; Miss C. K. E. Steel, to South Africa, from Guards' Hospital, London; Miss B. S. Vaughan, to South Africa, from Station Hospital, Chatham.

Appointments confirmed.—Sister Miss M. Smith. Staff Nurses: Miss E. M. Keays, Miss F. G. P. de S. Zrinyi, Miss E. L. McAllister, Miss G. M. Smith, Miss E. M. Perkins, Miss M. E. Wilkin, Miss A. M. MacCormac.

The following ladies have been warned to prepare for service abroad: Sister Miss C. G. Stronach. Staff Nurses: Miss M. MacGregor, Miss W. M. Jay, Miss E. Barber, Miss B. F. Perkins.

ARMY MEDICAL RESERVE OF OFFICERS.

Surgeon-Major A. A. Watson to be Surgeon-Lieutenant-Colonel, dated February 28, 1905.

ROYAL ARMY MEDICAL CORPS (MILITIA).

John Charles McCarroll, M.B., to be Lieutenant, dated February 18, 1905.

IMPERIAL YEOMANRY.

Royal North Devon (*Hussars*).—Surgeon-Lieutenant W. F. L. A. Holcroft, M.B., is seconded for service under the Colonial Office, dated January 21, 1905.

Lanarkshire (*Queen's Own Royal Glasgow*).—Surgeon-Captain H. Kelly, M.D., to be Surgeon-Major, dated February 18, 1905.

ROYAL ARMY MEDICAL CORPS (VOLUNTEERS).

The Edinburgh Company. — William Darling, Gent., to be Lieutenant, dated February 18, 1905.

The Aberdeen Company.—Lieutenant D. Rorie, from the Black Watch Bearer Company, to be Lieutenant, dated March 8, 1905.

OTHER VOLUNTEER CORPS.

1*st Gloucestershire, Royal Garrison Artillery* (*Volunteers*).—The following announcement is substituted for that which appeared in the *London Gazette* of January 3, 1905: Surgeon-Lieutenant-Colonel D. S. Davies, M.D., resigns his Commission, and is granted the honorary rank of Surgeon-Colonel, with permission to wear the prescribed uniform, dated January 4, 1905.

2*nd Volunteer Battalion the King's* (*Liverpool Regiment*).—Surgeon-Lieutenant-Colonel G. Westby (Brigade-Surgeon-Lieutenant-Colonel, Senior Medical Officer, Liverpool Volunteer Infantary Brigade) is granted the honorary rank of Surgeon-Colonel, dated February 18, 1905.

1*st Roxburgh and Selkirk* (*the Border*).—Surgeon-Lieutenant-Colonel J. S. Muir, M.B., resigns his Commission, and is granted the honorary rank of Surgeon-Colonel, with permission to wear the prescribed uniform, dated February 18, 1905.

2*nd Volunteer Battalion the Prince of Wales's Volunteers* (*South Lancashire Regiment*). — Ralph Richardson Brunskill, Gent., to be Surgeon-Lieutenant, dated February 18, 1905.

4*th Middlesex* (*West London*).—Surgeon-Major A. Clark (Brigade-Surgeon-Lieutenant-Colonel, Senior Medical Officer, 3rd London Volunteer Infantry Brigade) to be Surgeon-Lieutenant-Colonel, dated August 23, 1893.

5*th* (*Ardwick*) *Volunteer Battalion the Manchester Regiment.*—Surgeon-Captain S. Kersfield to be Surgeon-Major, dated February 18, 1905.

1*st Sutherland* (*the Sutherland Highland*).—Surgeon-Lieutenant J. MacLennan, M.B., resigns his Commission, dated February 18, 1905.

1*st Monmouthshire Royal Garrison Artillery* (*Volunteers*).—John O'Keefe, Gent., to be Surgeon-Lieutenant, dated February 25, 1905.

18*th Middlesex.*—Surgeon-Lieutenant-Colonel C. Godson, M.D., is granted the honorary rank of Surgeon-Colonel, dated February 25, 1905.

1*st Shropshire and Staffordshire Royal Engineers* (*Volunteers*).—Surgeon-Lieutenant-Colonel E. Cureton is granted the honorary rank of Surgeon-Colonel, dated March 8, 1905.

1*st Worcestershire Royal Garrison Artillery* (*Volunteers*).—Surgeon-Lieutenant G. H. Rutter, M.B., to be Surgeon-Captain, dated March 8, 1905.

3*rd Volunteer Battalion the Royal Fusiliers* (*City of London Regiment*).—James Searson, Gent., to be Surgeon-Lieutentant, dated March 8, 1905.

2*nd Volunteer Battalion the King's* (*Liverpool Regiment*).—Supernumerary Surgeon-Lieutenant J. G. Martin, M.B., to be Surgeon-Captain, and to remain supernumerary, dated March 8, 1905.

7*th Middlesex* (*London Scottish*).—Surgeon-Lieutenant A. H. Pirie, M.B., to be Surgeon-Captain, dated February 21, 1905.

ROYAL ARMY MEDICAL CORPS ANNUAL DINNER.

The Annual Dinner of the Corps will take place on Monday, June 19, at the "Whitehall Rooms," Hôtel Métropole, at 8 o'clock, precisely; the Director-General in the chair. Members intending to dine are requested to inform the Hon. Secretary as soon as possible, in order that the probable number attending may be known and that tickets may be sent.

All subscribers to the R.A.M.C. Fund, except any who may have expressly excluded the Annual Dinner in the allocation of their subscriptions, will be entitled to dine at subscribers' rates, provided that their subscriptions are credited to the R.A.M.C. Fund before the date of the dinner; also all Officers who do not subscribe to the R.A.M.C. Fund, but who still subscribe to the former R.A.M.C. Dinner Fund.

The price of the Dinner to subscribers will be reduced as much as the Fund will permit, but the exact amount cannot be fixed until the number of subscribers attending is known. In the last few years the charge has been 12s. 6d. The amount should be paid personally at the Hotel on the evening of the dinner.

The price to non-subscribers will be £1 15s., which must be sent by cheque or Post Office Order to the Hon. Secretary when applying for tickets. If the Officer is unable to dine the money will be returned.

H. C. Thurston, *Major*, *R.A.M.C.*,
Hon. Sec., *Sub-Committee*, *R.A.M.C. Dinner Fund.*

66, *Scarsdale Villas*, *Kensington*, *W.*

ROYAL ARMY MEDICAL CORPS FUND.

The Seventeenth Meeting of the Committee.

The Seventeenth Meeting of the Committee was held at 68, Victoria Street, S.W., on Friday, March 10, 1905, at 4 p.m.

Present.

Surgeon-General W. J. Fawcett (in the chair).
Lieutenant-Colonel E. M. Wilson, C.B., C.M.G., D.S.O. } Representing Retired
Lieutenant-Colonel A. B. Cottell. } Officers.
Colonel A. T. Sloggett, C.M.G.
Colonel H. E. R. James.
Lieutenant-Colonel R. H. Firth.
Captain G. St. C. Thom.
Captain and Quartermaster A. Bruce.

(1) The Minutes of the Sixteenth Meeting were confirmed.

(2) The Director-General notified the Committee that the de Chaumont Prize Trust Deed had been executed, and the original lodged with the Treasury Solicitor.

(3) With reference to the Forrest Memorial, the Chaplain of Aden intimated that a fee of Rs. 79 would be necessary for a faculty to place a brass in the Garrison Church there. It was obvious that such an expenditure was out of the question. The Director-General therefore suggested, and Mrs. Forrest agreed, that a piece of plate with a suitable inscription in memory of Captain Forrest should be purchased for the Royal Army Medical College Mess.

Colonel James has accordingly purchased a silver cigar lighter at a total cost of £4 17s. 6d. This was on view at the meeting, and met with approval.

(4) The Director-General circulated the following report of a conference with the Benevolent Fund for the consideration of the Committee:—

"The Sub-Committee consisting of (1) Surgeon-General Keogh, and (2) Lieutenant-Colonel R. H. Firth, R.A.M.C., with (3) Lieutenant-Colonel B. Skinner, R.A.M.C., Honorary Secretary to the Royal Army Medical Corps Fund, was received as arranged, on the subject of the Army Medical Officers' Benevolent Society.

"Surgeon-General Keogh stated that the Royal Army Medical Corps was anxious to make some provision to meet cases of distress among widows and orphans of officers of the Corps, and did not feel in a position to take any steps in the matter until the feeling of the subscribers to the Benevolent Fund had been ascertained.

"He mentioned that the Royal Army Medical Corps was providing for cases of distress among the non-commissioned officers and men of the Corps, and also among their wives and children, and that he felt the time was approaching when provision would be demanded by officers for their widows and orphans.

"The Secretary of the Benevolent Society pointed out that should the officers of the Royal Army Medical Corps join the Benevolent Society in greater numbers, the Fund could very easily merge into their own management in less time than two years; they could appoint their own Trustees, Committee of Management and Secretary, and make rules in accordance with their own ideas on the subject.

"Deputy Surgeon-General Innes explained that the interest derived from the invested funds of the Benevolent Society as well as the Annual Subscriptions,—chiefly given by officers on the Retired List—were distributed among the various applicants for assistance as seemed best to the Committee of Management, with the approval of the members present at the Annual General Meeting of the Society.

"On the suggestion of Colonel Welch, who thought that the Fund should be handed over to the Royal Army Medical Corps, supported by Deputy Surgeon-General Don, it was agreed that a Sub-Committee of the Benevolent Society composed of Deputy Surgeon-General Don and Lieutenant-Colonel Davies (Colonel Welch declining to act), in conjunction with the existing Sub-Committee of the Royal Army Medical Corps Fund, with Colonel Ligertwood as Secretary, meet and draw up a statement—under legal advice if necessary—for the administration of the Benevolent Society by the Royal Army Medical Corps Fund, and that this statement be submitted to the members of the Benevolent Society at the Annual General Meeting in June next, in time to enable the decision arrived at at such meeting to be submitted to the next General Meeting of the Royal Army Medical Corps Fund.

"Deputy Surgeon-General Don stated that it was difficult to get a Committee of Management, in accordance with the Rules of the Society.

"In answer to Colonel Firth the Secretary explained that the amount of dividends from invested stock varied, every two or three years, by the collection of the Rebate of Income Tax from the Inland Revenue Department.

"The Meeting then separated."

Surgeon-General Fawcett, on behalf of the Director-General, asked the Committee to consider the position. He informed the Committee that Colonel Fairland regretted his inability to be present. He would have liked to have discussed the question of provision for cases of distress among officers' families; Colonel Fairland considered this was undesirable, and beyond the scope of the Royal Army Medical Corps Fund; in his opinion officers who marry ought to provide in the insurance offices, and not to become a burden upon a Fund created among themselves.

After consideration of the matter the Committee agreed that the intention of officers at the last General Meeting would be met by action taken on the lines of the above Report of the Meeting between Surgeon-General Keogh's Sub-Committee and the Sub-Committee of the Benevolent Fund. The Committee was of opinion that the Corps would strongly support such action, as there was evidently a desire to meet cases of distress among officers' families. At the same time, the truth of Colonel Fairland's contention was recognised, namely, that this Fund is not an Insurance Fund and cannot take the place of insurance, or of any Fund like the Friendly Society, whose operations are on a footing entirely distinct from those of the Benevolent Fund.

(5) The following Canteens have sent contributions to the Royal Army Medical Corps Fund (General Relief), which they hope to repeat annually, and in some cases oftener:—

10th Company, Thames District	£5	0	0
3rd Company, Alton	1	0	0
16th Company, Cork	2	0	0
Canteen, R.A.M.C., Colchester	5	0	0
12th Company, Woolwich	10	0	0

The following Canteens have promised to subscribe annually to the General Relief Fund:—

14th Company, Dublin	£2	2	0
20th Company, Tidworth	3	0	0
Depôt, Aldershot	50	0	0
Detachment, Cottonera, Malta	2	10	0
Detachment, Valetta, Malta	5	0	0

The other Canteens have not yet replied to a communication on the subject.

(6) At the last meeting of the Committee the sum of £6 was voted to the Loyal Women's Guild of South Africa for the purpose of placing coping stones round the graves of some of the Royal Army Medical Corps who were buried at Braamfontein, Johannesburg. In the same cemetery are buried three men of the St. John Ambulance Brigade who died during the war, and whose graves require the same care and attention

as the graves already provided for as noted above. The Director-General considers that as these men were serving with us in South Africa, it would be at least a graceful act, if the Royal Army Medical Corps Fund made a grant for the preservation of their graves similar to that noted at the last meeting.

The Committee unanimously resolved that a sum of £4 10s. should be handed over from the Royal Army Medical Corps Fund (Memorial Fund) to the Loyal Women's Guild of South Africa for the above purpose.

(7) It was noted that a further sum of £500 had been placed on deposit, bringing the total amount up to £2,000, exclusive of the deposit on account of the Charitable Schools Fund.

B. Skinner, Lieutenant-Colonel,

March 11th, 1905. *Hon. Secretary.*

THE ROYAL ARMY MEDICAL CORPS FUND.

Notice of Third General Meeting.

The Third General Meeting of subscribers to this Fund will be held in the Theatre of the Royal United Service Institution, on Monday, June 19, 1905, at 3 p.m. The Director-General will preside.

It is hoped that officers will freely express their views on any points connected with the Fund which they may wish discussed. Those officers who wish for information at the meeting on any special point are asked to communicate with the Hon. Secretary at 68, Victoria Street, S.W., in order that facts and figures may be prepared in response to any question asked.

The Director-General wishes to remind subscribers that the question of the Benevolent Fund being administered by the Royal Army Medical Corps Fund will be before the meeting. It is hoped that the subscribers to the Benevolent Fund will lay their views before this General Meeting of the Royal Army Medical Corps Fund subscribers.

The question of the "Colours" will also be up for final decision.

MARRIAGES.

DONEGAN—SUTTON.—At Kasr-el-Nil Barracks, Cairo, on February 16, Major J. D. F. Donegan, R.A.M.C., eldest surviving son of the late Daniel Valentine Donegan, of Monkstown, co. Cork, to Amy, youngest daughter of the late R. A. Sutton and Mrs. Sutton, of Rose Lodge, Blackrock, co. Cork, Ireland.

LE BAS—DE CRESPIGNY.—On December 22, at St. Peter's, Eaton Square, by the Rev. T. B. Woodd, Dumaresq Le Bas, R.A.M.C., only son of the late Dumaresq Le Bas, of Monte Video, Uruguay, to Mary, widow of the late Robert de Crespigny, of Sandy Mount, Dublin.

NOTICE TO SUBSCRIBERS.

Officers are particularly requested to give timely notice of changes of station or changes of address, in order to ensure the posting of the Journal to its correct destination.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, &c. He will also be glad to receive items of news and information regarding matters of interest to the Corps from the various garrisons, districts and commands at home and abroad. All these communications should be written upon one side of the paper only, they should by preference be type-written, but, if not, all proper names should be written in capital letters (or printed) to avoid mistakes, and be addressed to the Editor, Journal of the Royal Army Medical Corps, 68, Victoria Street, London, S.W.

Letters regarding subscriptions, non-delivery of the Journal, or change of address, should be sent to Major T. McCulloch, R.A.M.C., 68, Victoria Street, London, S.W.

Communications have been received from Surgeon-General W. F. Stevenson; Lieutenant-Colonels B. Skinner, R. Simpson; Majors Glenn Allen, E. C. Freeman, W. T. Mould, S. Macdonald, R. F. E. Austin, W. B. Leishman, F. Smith, J. H. Brannagan, C. E. Pollock, H. P. G. Elkington, C. J. W. Tatham; Captains E. Blake Knox, L. F. Smith, R. J. Blackham, J. T. Clapham, J. H. P. Graham (Militia); Lieutenants A. B. Smallman, N. E. Harding.

In the event of reprints of articles being required by the authors, notification of such must be sent when submitting the papers. Reprints may be obtained at the following rates:—

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25 Copies of 4 pp.	4	6	Of 8 pp.	7	6	Extra for covers	4	0
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The following periodicals have been received: *The Medical Record, The Medical News, New York Medical Journal, American Medicine, Gazette Med. de Paris, Archives de Medicine et de Pharmacie Militaires, Il Morgagni, Gazetta Medico-Italiana, The Medical Review, El Siglo Medico, Der Militärärzt, Deutsche Militärärztliche Zeitschrift, Anales de Sanidad Militar, Revue Med. de la Suisse Romande, La Medicina Militar Espanola, The Boston Medical and Surgical Journal, Annali di Med. Navale, Giornale del Regio Esercito, Le Caducée, The Hospital, The Ophthalmoscope, St. Thomas's Hospital Gazette, Bulletin de l'Acad. de Med. de Paris, Arch. Med. Belges, Voyenno Medisinskii, The Indian Medical Gazette, The Australasian Medical Gazette, Journal of the Association of Military Surgeons, U.S., Militärlagen ungwet af Militärlaegeforeningen, i Kjobenharn, The Veterinary Journal, The Practitioner, Public Health, Medical Review, The Army and Navy Gazette, The United Service Gazette, Journal of the Royal United Service Institution, The Johns Hopkins Press.*

We desire to remind members who paid their first year's subscription by cheque or Postal Order that the annual subscription is due on July 1, and it is very important that such should be promptly paid.

All Applications for Advertisements to be made to—

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NOTICE.

The Corps News is now printed as an inset to the Journal and separate copies may be subscribed for, price 2d. monthly.

Distribution List of Officers

OF THE

ARMY MEDICAL STAFF

AND

ROYAL ARMY MEDICAL CORPS.

[*This List is prepared according to the latest information received. Officers are invited to communicate any particulars regarding alterations, errors, or omissions, to Major T. McCULLOCH, R.A.M.C., 68, Victoria Street, S.W.*]

SPECIALIST CERTIFICATES IN:

a = State Medicine (R.A.M. College qualification).
b = Diploma in Public Health.
c = Bacteriology.
d = Dental Surgery.
e = Dermatology and Venereal Diseases.
f = Specific Fevers.
g = Laryngology.
h = Midwifery and Gynæcology.
j = Operative Surgery.
k = Ophthalmology.
l = Otology.
m = Pædiatrics.
n = Psychological Medicine.
o = Skiagraphy.
p = Tropical Medicine.

ARMY MEDICAL SERVICE.

HEADQUARTER STAFF.

Rank.	Name.	Appointment.
Surgeon-General ..	Keogh, A., M.D., C.B.	Director-General of Army Med. Services.
,, ,, ..	Fawcett, W. J., M.B., C.B. ..	Deputy Director-General.
Lieutenant-Colonel .	Babtie, W., M.B., V.C., C.M.G...	Assistant Director-General.
Major	McCulloch, T., M.B.	Deputy Assistant Director-General.
Lieutenant-Colonel	Russell, M. W.	,, ,, ,, ,,
Major	Thurston, H. C., C.M.G.	,, ,, ,, ,,

ARMY MEDICAL SERVICE ADVISORY BOARD.

Rank.	Name.	Appointment.
Brevet-Colonel ..	Bruce, D., F.R.S., M.B.	Expert in Tropical Diseases.
Lieutenant-Colonel .	Davies, A. M.	Expert in Sanitation.
,, ,,	Skinner, B. M.	Secretary.

ROYAL ARMY MEDICAL COLLEGE.

Rank.	Name.	Appointment.
Colonel (temporary)	James, H. E. R.	Commandant and Director of Studies.
Surgeon-General (temporary)	Stevenson, W. F., M.B., C.B., K.H.S.	Prof. of Clinical and Military Surgery.
Lieutenant-Colonel .	Firth, R. H.	Professor of Military Hygiene.
Major	Leishman, W. B., M.B.	,, ,, Pathology.
,, ...	Fowler, C. E. P.	Assistant Professor of Military Hygiene.
Captain	Harvey, D., M.B.	,, ,, Pathology.

SURGEON-GENERALS.

Name.	Station.	Appointment.
Burnett, W. F.	Eastern Command, India ..	Principal Medical Officer.
Clery, J. A., M.B., C.B.	Southern Command, England ..	,, ,, ,,
Charlton, W. J.	Eastern Command, England ..	,, ,, ,,
Donovan, W., C.B.	South Africa	,, ,, ,,
Edge, J. D., M.D., C.B... ..	Irish Command	,, ,, ,,
Fawcett, W. J., M.B., C.B. ..	Headquarter Staff	,, ,, ,,
Gallwey, Sir T. J., M.D., K.C.M.G., C.B. ..	India	,, ,, ,,
Gubbins, W. L., M.B., M.V.O...	Western Command, India ..	,, ,, ,,
McNamara, W. H., M.D., C.B., C.M.G.	Aldershot Command	,, ,, ,,
Townsend, Sir E., M.D., K.C.B., C.M.G.	Netley	,, ,, ,,

COLONELS.

Name.	Station.	Appointment.	Specialist Certificates in.
Barrow, H. J. W.	Ambala, India	Principal Medical Officer	—
Blennerhassett, B. M., C.M.G.	Rawalpindi, India ..	,, ,, ,, ...	—
Bourke, G. D.	Devonport	Administrative Medical Officer ..	—
Chester, W. L., M.B. ..	Peshawar, India	Principal Medical Officer	—
Dorman, J. C., M.B., C.M.G.	Cape Colony, S. Africa ..	,, ,, ,, ...	—
Duke, A. W., M.D. ..	Chester	Principal Medical Officer, Welsh and Midland Commands	—
Ellis, P. M.	Curragh	Administrative Medical Officer ..	—
Fenn, E. H., C.I.E. ..	Chatham	,, ,, ,, ..	—
Hughes, G. A., M.B., D.S.O.	Edinburgh	Principal Medical Officer, Scottish Command	—
Kenny, W. W., M.B. ..	Pretoria	Principal Medical Officer, Transvaal District	—
Leake, G. D. N.	Lucknow, India	Principal Medical Officer	—
McNamara, J., M.D. ..	Gibraltar	,, ,, ,, ...	—
May, W. A., C.B.	Tidworth	Administrative Medical Officer ..	—
Magill, J., M.D., C.B. ..	Cairo	Principal Medical Officer, H.M. British Troops, Egypt	—
Morris, J. J., M.D. ..	Portsmouth	Administrative Medical Officer ..	—
O'Connell, M. D., M.D. ..	York	Principal Medical Officer, Northern Command	—
Pratt, W. S., M.B. ..	Mhow, India	Principal Medical Officer	—
Quill, R. H., M.B. ..	Dover	Administrative Medical Officer ..	—
Rainsford, W. J. R., C.I.E.	Bermuda	Principal Medical Officer	—
Routh, J. I.	India	.. ..	—
Stevenson, W. F., M.B., C.B., K.H.S. (temporary Surgeon-General)	London	R.A.M. College	—
Saunders, W. E., C.B. ..	Naini Tal, India	Officiating Principal Medical Officer, Eastern Command	—
Slaughter, W. B.	Colchester	Administrative Medical Officer ..	—
Swayne, C. H., D.S.O. ..	Cork	,, ,, ,, ..	—
Sloggett, A. T., C.M.G. ..	London District	Principal Medical Officer	—
Trevor, F. W., M.B. ..	Poona, India	,, ,, ,, ...	—
Webb, W. E., M.D. ..	Hong Kong	,, ,, ,, S. China	b.
Williamson, J. F., M.B., C.B., C.M.G.	Bombay, India	,, ,, ,, ...	—
Wolseley, W. O.	Malta	,, ,, ,, ...	—
Whitehead, H. R. ..	India	.. ..	—

LIEUTENANT-COLONELS.

(Under Article 365 of the Royal Warrant.)

Anderson, L. E.	London	Temporary duty, Headquarters ..	—
Babtie, W., M.B., V.C., C.M.G.	War Office, London ..	Headquarter Staff	—
Bruce, D., F.R.S., M.B. (Brevet-Colonel)	London	Expert in Tropical Diseases, Army Medical Service Advisory Board	—
Bedford, W. G. A., M.B., C.M.G.	Gibraltar	Officer in charge Military Hospital	—
Corker, T. M., M.D. ..	Belfast	Administrative Medical Officer ..	—

Name.	Station.	Appointment.	Specialist Certificates in.
Coutts, G., M.B.	Salisbury	Assistant to Principal Medical Officer, Southern Command	—
Croly, A. E. J.	Edinburgh	Officer in charge Military Hospital and Officer Commanding 13th Coy. R.A.M.C.	—
Dodd, J. R., M.B. ..	Mhow, India	Officer in charge Military Hospital	—
Emerson, I. B.	York	,, ,, ,, ,,	—
Forman, R. H., M.B. ..	Woolwich	Officer in charge Royal Herbert Hospital	—
Ford, R. W., D.S.O. ..	Royal Hospital, Chelsea	Deputy Surgeon	—
Goggin, G. T.	Belfast	Officer in charge Military Hospital	—
Hodson, R. D.	Ceylon	Senior Medical Officer	—
Harwood, J. G.	Portsmouth	Officer in charge Military Hospital	—
Heffernan, W.	Wynberg, S. Africa ..	,, ,, ,, ,,	—
Hathaway, H. G. ..	Poona, India	,, ,, ,, ,,	—
Inman, A. W. P., M.B. ..	Allahabad, India	Offg. Principal Medical Officer ..	—
Johnston, P. H., M.D., C.M.G.	Jamaica	Senior Medical Officer and Officer Commanding, R.A.M.C.	—
Johnston, W. T., M.D. ..	Canterbury	Officer in charge Military Hospital	—
Jennings, R., M.D. ..	Valetta, Malta	.. ..	—
Jones, J. M.	Devonport	Officer in charge Military Hospital and Officer Commanding 7th Coy. R.A.M.C.	— —
Kirkpatrick, H. C., M.D.	Barbados	Senior Medical Officer	—
Kerin, M. W.	Peshawar, India	Officer in charge Military Hospital and Principal Medical Officer Khyber movable column	—
Lloyd, O. E. P., V.C. ..	Ootacamund, India ..	Staff Officer to Madras Division of the Army Bearer Corps	—
Love, R. L., M.D... ..	Fermoy	Officer in charge Military Hospital	—
MacNeece, J. G.	Dublin	Medical Inspector of Recruits, Irish Command	—
Moffitt, T. B.	Lucknow, India	Officer in charge Military Hospital	—
Martin, H., M.B... ..	Shorncliffe..	,, ,, ,, ,,	—
Mulvany, P.	Alton	Officer in charge Princess Louise Hospital	—
MacNeece, T. F.	Cork	Officer in charge Military Hospital	—
Maclean, F. B.	Woolwich	Standing Board Survey Army Medical Stores	
Macnamara, W. J., M.D.	Bloemfontein, S. Africa ..	Principal Medical Officer Orange River Colony and Officer in charge Military Hospital	—
Milward, E. O.	Southampton	Embarkation Medical Officer ..	—
Murray, H. W., M.B. ..	Halifax, N.S.	Senior Medical Officer and Officer in command, R.A.M.C., Canada	—
Maunsell, E. L.	Gosport	Officer in charge Military Hospital	—
Mosse, C. G. D.	Winchester	,, ,, ,, ,,	—
Moberley, H. J. R. ..	Aldershot	Officer in charge Connaught Hosp.	—
North, E. (Col., Mauritius)	Mauritius	Senior Medical Officer	—
O'Connor, A. P., C.B. ..	Bordon	Administrative Medical Officer ..	—
O'Sullivan, D.	Mian Mir, India	Officer in charge Military Hospital	—
Peterkin, A., M.B. ..	Curragh	Officer in charge Military Hospital and Officer Commanding 17th Coy. R.A.M.C.	—
Roche, E. A.	Chatham	Officer in charge Military Hospital and Officer Commanding 10th Coy. R.A.M.C.	— —
Robinson, G. W.	Aldershot	Officer Comdg. Depôt, R.A.M.C...	—
Robinson, S. C. B. ..	Colchester	Officer in charge Military Hospital	
Somerville-Large, B. W..	York	.. ..	—
Seymour, C., M.B. ..	Royal Hospital, Chelsea..	Physician and Surgeon	—
Sylvester, G. H.	Netley	In charge Surgical Division ..	—
Todd, O., M.B.	Cairo, Egypt	Officer in charge Military Hospital	—

Name.	Station.	Appointment.	Specialist Certificates in.
Twiss, G. E.	Netley	Registrar and Secretary	—
Webb, C. A.	Dover	Officer in charge Military Hospital	b.
Wardrop, D., M.B.	Rawalpindi, India	,, ,, ,, ,,	—
Woods, C. R., M.D.	Dublin	Officer in charge Royal Infirmary and Officer Commanding 14th Coy. R.A.M.C.	b.

LIEUTENANT-COLONELS.

Name.	Station.	Appointment.	Specialist Certificates in.
Allport, H. K., M.D.	Bulford	Officer in charge Military Hospital	—
Burlton, A. H.	Returning to England, tour expired		—
Battersby, H. L.	Bareilly	Officer in charge Military Hospital	—
Baker, W. J.	Returning to England, tour expired		—
Butt, E.	Dublin	.. ..	—
Birrell, W. G., M.B.	Edinburgh	Medical Inspector of Recruits, Scottish Command	—
Brazier-Creagh, G. W., C.M.G.	Fyzabad, India	Officer in charge Military Hospital	—
Barratt, H. J.	Agra, India	,, ,, ,, ,,	—
Burton, F. H. M., M.D.	Standerton, S. Africa	.. ..	—
Bartlett, C. R.	Tower Hill, West Africa	Senior Medical Officer and in charge Military Hospital	—
Brooke-Pechell, Sir A. A., Bt., M.B.	Portsmouth	.. ..	
Bond, R. P.	Returning to England, tour expired		—
Braddell, M. O'D., M.B.	Woolwich	Registrar and Secretary Royal Herbert Hospital, Officer Commanding 12th Coy. R.A.M.C.	—
Battersby, J., M.B.	Chester	Medical Inspector of Recruits, Welsh and Midland Command	—
Beevor, W. C., M.B., C.M.G.	Karachi, India	Officer in charge Military Hospital	—
Birt, C.	Pretoria, S. Africa	In charge A.M.S. Laboratory	—
Berryman, W. E.	Dover	.. ..	—
Cowen, W. D. A.	Alderney, C.I.	Officer in charge Military Hospital	—
Culling, J. C.	Pembroke Dock	,, ,, ,, ,,	—
Carmichael, J.	Warley	,, ,, ,, ,,	—
Caldwell, R.	Meerut, India	Officer in charge Military Hospital and in charge Dist. Laboratory	b.
Daly, F. A. B., M.B., C.B.	Standerton, S. Africa	Officer in charge Military Hospital	—
Davies, A. M.	London	Expert in Sanitation, Army Medical Service Advisory Board	b.
Dundon, M.	Devonpor	Anæsthetist	—
Dick, W.	Fort Canning, S. Setts.	Senior Medical Officer	b.
Donnet, J. J. C.	Quetta, India	.. ..	—
Dugdale, W.	Wynberg, S. Africa	.. ..	—
Dempsey, P. J., M.D.	Portsmouth	Officer in charge Military Hospital	—
Dodd, A.	Chester	,, ,, ,, ,,	—
Duncan, S. E.	Returning to England, tour expired		—
Flanagan, J. W. H.	Lichfield	Officer in charge Military Hospital	—
Franklin, D. F.	Chakrata, India	,, ,, ,, ,,	—
Faunce, C. E.	Bombay, India	.. ..	—
Firth, R. H.	London	R.A.M. College	b.
Freyer, S. F., M.B., C.M.G.	Aldershot	.. ..	—
Forrest, J. R.	Ahmedabad, India	Officer in charge Military Hospital	b.
Geoghegan, A. O., M.D.	Bury	,, ,, ,, ,,	—
Gibson, J., M.B.	Templemore	,, ,, ,, ,,	—
Geddes, R. J., M.B., D.S.O.	Maryhill	,, ,, ,, ,,	b.
Gubbin, G. F.	Eastern Comd., England	.. ..	b.

Name.	Station.	Appointment.	Specialist Certificates in.
Hall, J. L...	Quetta, India	Officer in charge Military Hospital	—
Hetherington, R. P., M.D.	Dublin	Officer in charge Military Hospital, Portobello	—
Hubbard, H. W.	Aldershot	Officer in charge Cambridge Hosp.	—
Hackett, R. I. D.	Harrismith, S. Africa	Senior Medical Officer and Officer in charge Military Hospital	—
Haslett, J. C., M.D.	Allahabad, India	Officer in charge Military Hospital	—
Hale, G. E., D.S.O.	Kirkee, India	,, ,, ,, ,,	—
Hamilton, T. W. O'. H., M.B., C.M.G.	Limerick	,, ,, ,, ,,	—
Heuston, F. S., C.M.G.	Royal Hosp., Kilmainham	Physician and Surgeon	—
Hunter, G. D., D.S.O.	Egypt	Principal Medical Officer Egyptian Army	—
Haines, H. A., M.D.	Dalhousie, India	Officer in charge Military Hospital	—
Henderson, R. S. F., M.B.	Deesa, India	Officer in charge Military Hospital Station Staff and Detachment Laboratory	—
Irvine, D. L.	Aldershot	In charge Cavalry Brigade	—
Irwin, J. M., M.B.	,,	Assistant to Principal Medical Officer, Aldershot Army Corps	—
Johnston, H. H., M.D., C.B.	Netley	In charge Medical Division	b.
Jencken, F. J., M.B.	Deolali, India	Officer in charge Military Hospital	—
James, H. E. R. (temporary Colonel.)	London	R.A.M. College	b.
Johnson, C. W., M.B.	Cawnpore, India	In charge Cantonment Hospital	—
Kay, A. G., M.B...	Netley	Officer in charge Lunatic Hospital	—
Kirkpatrick, R., M.D., C.M.G.	Jullundur, India	Officer in charge Military Hospital	—
Lucas, T. J. R., M.B.	Alexandria, Egypt	,, ,, ,, ,,	—
Lane, A. V.	Glasgow	In charge Recruiting Duties	—
Lambkin, F. J.	Returning to England, tour expired		—
Lougheed, S. F., M.D., C.M.G.	Royal Arsenal, Woolwich	Senior Medical Officer	—
Lynden-Bell, E. H. L.	Allahabad, India		—
Lilly, A. T. J.	Returning to England, tour expired		—
McCreery, B. T., M.B.	Kinsale	Officer in charge Military Hospital	b.
Morse, R. E. R.	Newcastle-on-Tyne	,, ,, ,, ,,	—
Magrath, C. W. S., M.D.	Hilsea	,, ,, ,, ,,	—
Morris, W. A.	Sialkot, India	,, ,, ,, ,,	—
McGill, H. S.	Returning to England, tour expired		b.
Macpherson, W. G., M.B., C.M.G.	Attached Japanese Army		b.
Moore, R. R. H., M.D.	Aldershot	In charge R.E., A.S.C., & R.A.M.C.	—
Maher, J.	Sandhurst	Surgeon R.M.C.	—
Manders, N.	Curepipe, Mauritius	Officer in charge Military Hospital	—
Moffet, G. E., M.B.	Perth	,, ,, ,, ,,	b.
Noding, T. E.	Middelburg, Transvaal	,, ,, ,, ,,	—
Nicholls, F. P., M.B.	Barbados	,, ,, ,, ,,	—
Nichol, C. E., M.B., D.S.O.	Ranikhet, India	,, ,, ,, ,,	—
O'Keefe, M. W., M.D.	Woolwich	In charge Medical Division Royal Herbert Hospital	—
O'Donnell, T. J., D.S.O.	Preston	Officer in charge Military Hospital	—
O'Brien, R. F.	Sheerness	Officer in charge Military Hospital and Recruiting	—
O'Connell, D. V., M.D.	Gibraltar	In charge Staff and Departments	b.
Porter, R., M.B.	Pretoria, S. Africa	Officer in charge Military Hospital	—
Pike, W. W., D.S.O.	India		—
Rhodes, J. H. A.	Valetta, Malta	Officer in charge Military Hospital	—
Rowney, W., M.D.	Cawnpore, India	,, ,, ,, ,,	—
Rose, A. S., M.D.	Meerut, India	,, ,, ,, ,,	—
Risk, E. J. E.	Holywood	,, ,, ,, ,,	—

Name.	Station.	Appointment.	Specialist Certificates in.
Reade, W. L.	Weedon	Officer in charge Military Hospital	—
Russell, A. F., M.B., C.M.G.	London	Medical Inspector of Recruits, Eastern Command	—
Reckitt, J. D. T.	Multan, India	Officer in charge Military Hospital	—
Reilly, C. C.	Murree, India	,, ,, ,, ,,	—
Russell, M. W.	War Office, London ..	See Headquarter Staff	—
Reid, J. M., M.D. ..	Salisbury	Medical Inspector of Recruits, Southern Command	—
Sliabey, L. W.	Calcutta, India	.. ..	—
Sawyer, R. H. S., M.B. ..	S. Africa	.. ..	—
Skinner, B. M.	London	Secretary, Army Medical Service Advisory Board	—
Simpson, R. J. S., M.B., C.M.G.	London	Assistant to Principal Medical Officer, Eastern Command	—
Semple, D., M.D. ..	Kasauli, India	In charge Anti-rabic Institute ..	—
Stuart, J. R., M.B. ..	Fort George	Officer in charge Military Hospital	—
Sloggett, H. M.	Cottonera, Malta	,, ,, ,, ,,	—
Scanlan, A. De C. ..	Aldershot	Officer in charge Isolation Hosp.	—
Townsend, S., M.D. ..	Wellington, India ..	Officer in charge Military Hospital	—
Thiele, C. W., M.B. ..	Warrington	,, ,, ,, ,,	—
Treherne, F. H.	Nowshera, India	Officer in charge Military Hospital and Cantonment Hospital	b.
Trevor, H. O.	Aldershot	Medical Inspector of Recruits for Aldershot Army Corps	—
Tyrrell, C. R.	Shorncliffe	.. ..	—
Thompson, W. B. ..	Portsmouth	In charge Military Families Hosp.	—
Tate, A. E.	Nasirabad, India	Staff-Surgeon in charge Army Hd.-qr. Staff and Establishment	—
Thompson, H. N., M.B., D.S.O.	Woking	Officer in charge Military Hospital	—
Turner, W.	Kasauli, India	,, ,, ,, ,,	—
White, H. L. E.	Woolwich	Recruiting Duties	—
Woodhouse, T. P. ..	Ambala, India	Officer in charge Military Hospital	—
Weston, G. E.	Prospect, Bermuda ..	,, ,, ,, ,,	—
Wight, E. O.	Hounslow	Officer in charge Military Hospital and Recruiting	—
Westcott, S., C.M.G. ..	York	Medical Inspector of Recruits, Northern Command	—
Wyatt, H. J.	Curragh	.. ..	—
Wilson, G., M.B.	Ferozepore, India ..	.. ..	—
Winter, T. B.	Returning to England, tour expired	.. ..	—
Yourdi, J. R., M.B. ..	Secunderabad, India ..	Officiating Principal Medical Officer and Officer in charge Military Hospital	—

MAJORS.

Adams, G. G.	Nowgong, India	Officer in charge Military Hospital	—
Allen, S. G.	Ambala, India	.. ..	b.
Adamson, H. M., M.B. ..	Bareilly, India	.. ..	—
Aldridge, A. R., M.B. ..	Naini Tal, India	Sanitary Officer, Eastern Commd.	b.
Austin, H. W.	Quetta, India	.. ..	—
Allport, C. W., M.D. ..	Fort Allahabad, India ..	Officer in charge Military Hospital	—
Alexander, G. F., M.B. ..	Bloemfontein, S. Africa ..	.. ..	—
Austin, J. H. E.	Fort Canning, S. Setts. ..	Officer in charge Military Hospital	—
Anderson, E. C., D.S.O...	Shorncliffe	.. ..	—
Alexander, J. D., M.B. ..	Returning to England, tour expired	.. ..	—
Austin, R. F. E.	Imtarfa, Malta	Officer in charge Military Hospital	—

Name.	Station.	Appointment.	Specialist Certificates in.
Anderson, J. B.	Meerut, India	..	c.
Buchanan, G. J., M.B.	Bareilly, India	In charge District Laboratory	—
Bray, H. A.	Attached Egyptian Army	..	—
Buswell, F. R.	Belgaum, India	..	—
Black, J. G., M.D.	Wei-hai-Wei, N. China	..	—
Buchanan, J. B. W., M.B.	Darjeeling, India	Officer in charge Military Hospital, Cantonment Hospital, and Gurkha Recruiting Depôt	—
Brown, H. H., M.B.	Sheffield	..	—
Baylor, H. T.	Shorncliffe	..	—
Burtchaell, C. H., M.B.	S. Africa	S. African Constabulary	—
Bent, G.	India	..	—
Barefoot, G. H.	St. Lucia, West Indies	Officer in charge Military Hospital	—
Browning, T.	Buttevant	,, ,, ,, ,,	—
Buist, R. N., M.B.	Sialkot, India	..	—
Burnside, E. A.	Punjab, India	..	—
Browne, E. G.	Ireland	..	—
Bullen, J. W., M.D.	Mullingar	Officer in charge Military Hospital	—
Boles, W. S., M.B.	Dundalk	,, ,, ,, ,,	—
Bate, A. L. F.	Mhow, India	..	—
Blenkinsop, A. P.	Lucknow, India	..	—
Borradaile, A. L., M.B.	Brecon	Officer in charge Military Hospital	—
Birt, T.	Returning to England, tour expired		—
Beach, T. B.	Shoeburyness	..	—
Bewley, A. W.	Dublin	..	—
Beveridge, W. W. O., M.B., D.S.O.	London	In charge Chelsea Barracks	b.
Bray, G. A. T.	India	..	—
Buist, H. J. M., M.B., D.S.O.	Pretoria, S. Africa	Staff Officer to Principal Medical Officer, S. Africa	—
Brogden, J. E.	Portland	Officer in charge Military Hospital	—
Begbie, F. W.	Returning to England, tour expired		—
Beyts, W. G.	Ambala, India	..	—
Blackwell, C. T., M.D.	Quetta, India	Officer in charge District Laboratory	b.
Brannigan, J. H.	Sheffield	Officer in charge Military Hospital	—
Berryman, H. A.	Gibraltar	Company Officer	o.
Cree, H. E.	Dover	In charge Recruiting	—
Cocks, H., M.B.	Bangalore, India	..	—
Corkery, T. H.	Devonport	In charge Military Prison and Recruiting	—
Clarkson, T. H. F.	Jersey	Officer in charge Military Hospital, Fort Regent	—
Cottell, R. J. C.	Woolwich	Officer in charge Military Families Hospital	h.
Cummins, H. A., M.D., C.M.G.	Rawalpindi	..	b.
Cockerill, J. W.	Prospect, Bermuda	In charge Effective Troops	—
Clark, S. F., M.B.	Cape Colony, S. Africa	Sanitary Officer	b.
Copeland, R. J., M.B.	Portsmouth	..	—
Connor, J. C., M.B.	Ireland	..	—
Crawford, G. S.	Aldershot	Officer in charge 3rd Brigade	b.
Condon, E. H., M.B.	Ambala, India	..	—
Chambers, A. J.	Netley	In charge Staff and Families	—
Cardoza, S. N.	Golden Hill, I. of Wight	Officer in charge Military Hospital	—
Cree, G.	Devonport	In charge Hospital for Soldiers' Wives and Children	—
Curtis, J. H.	Returning to England, tour expired		—
Collins, D. J., M.B.	Dublin	Anæsthetist Royal Infirmary	k. b.
Carr, H., M.D.	Mount Abu, India	Officer in charge Military Hospital and Lawrence School	—

Name.	Station.	Appointment.	Specialist Certificates in.
Durant, R. J. A.	Dum Dum, India.. ..	Officer in charge Military Hospital, Ammunition Factory, Cossipore and Dukinsore Factories, and Cantonment Outdoor Dispensary	—
Davis, E.	Subathu, India	Officer in charge Military Hospital and Cantonment Hospital	—
Day, W. B., M.B. ..	Curragh	In charge Hospital for Soldiers' Wives and Children	—
Daly, J. H.	Queenstown	.. ..	—
Daly, T.	Poonamallee, India ..	Officer in charge Military Hospital	—
Davidson, J. S., M.B. ..	Parkhurst	,, ,, ,, ,,	—
Donegan, J. F.	Cairo, Egypt	Officer in charge Military Hospital, Kasr-el-Nil	—
Donaldson, J.	Agra, India	.. ..	—
Dowman, W. S.	India	.. ..	—
Davoren, V. H. W. ..	Devonport	Company Officer	—
Dalton, C.	India	.. ..	—
Duggan, C. W., M.B. ..	India	.. ..	—
Dunn, H. N., M.B. ..	Royal Arsenal, Woolwich	.. ..	—
Elderton, F. D.	Newport, Mon.	Officer in charge Military Hospital	—
Elkington, H. P. G. ..	Aldershot	Sanitary Officer, Aldershot Army Corps	b.
Eckersley, E., M.B. ..	Woolwich	.. ..	—
Edye, J. S.	India	.. ..	—
Elliott, C. R., M.D. ..	Poona, India	Sanitary Offi., Western Command	b.
Erskine, W. D., M.B. ..	Khartoum, Soudan, Egypt	Officer in charge Military Hospital	
Ferguson, N. C., M.B., C.M.G.	Middleburg, Cape Colony	,, ,, ,, ,,	b.
Fallon, J.	Dagshai, India	,, ,, ,, ,,	
Fayrer, J., M.D.	Duke of York's School ..	Officer in Medical charge ..	—
Freeman, E. C.	Colchester	Sanitary Officer, Northern Area, Eastern Command	b.
Forde, B., M.B.	Middelburg, Transvaal ..	.. ..	—
Ferguson, J. D., D.S.O. ..	Cork	.. ..	—
Faichnie, N., M.B. ..	York	Sanitary Offi., Northern Command	b.
Fleming, C. C., M.B., D.S.O.	Glasgow	Adjutant Glasgow Coy., R.A.M.C. (Volunteers)	—
Faichnie, F. G.	Jubbulpore, India ..	In charge Gun Carriage Factory and District Laboratory	—
Fletcher, H. J., M.B. ..	Chatham	Officer in charge Casualty Hospital and Recruiting	—
Fitzgerald, A. O.	Gosport	.. ..	—
Fowler, C. E. P.	London	R.A.M. College	k. b.
Green, J. S., M.B. ..	Dublin	.. ..	—
Gordon, P. C. H.	Bangalore, India	.. ..	—
Griffiths, A. P. H. ..	Birmingham	Officer in charge Military Hospital	—
Gerrard, J. J., M.B. ..	Eastern Commd., England	.. ..	—
Garner, C., M.B.. ..	Egyptian Sanitary Department	.. ..	—
Gray, W. L., M.B. ..	Valetta, Malta	Sanitary Officer and in charge Laboratory	b.
Girvin, J.	London	In charge Wellington Barracks and Company Officer	—
Graham, W. A. S. J. ..	Chatham	Casualty Hospital	—
Gibbard, T. W., M.B. ..	London	Adjutant London Coy., R.A.M.C. (Volunteers)	k.
Goodwin, T. H. J. C., D.S.O.	Woolwich	Officer in charge Cadet Hospital, Royal Military Academy	j. o.
Greig, F. J.	Aldershot Depôt	2nd in Command and Instructor	—
Hickson, S., M.B. (Brevet-Lieutenant-Colonel)	Woolwich	In charge Surgical Division, Royal Herbert Hospital	—
Hearn, M. L.	N. China	Senior Medical Officer	—

Name.	Station.	Appointment.	Specialist Certificates in.
Hall, R. H., M.D.	Cork	Company Officer, Anæsthetist, and in charge of Recruiting	—
Hanley, R. G., M.B.	Rawalpindi, India	.. ..	—
Harris, F. W. H. D.	Bodmin	Officer in charge Military Hospital	
Hall, F. W. G., M.B.	India	.. ..	—
Hayman, S. J. W.	Barrackpore, India	.. ..	—
Hennessy, D., M.D.	Athlone	Officer in charge Military Hospital	—
Hall, R. J. D.	Holywood	.. ..	—
Hosie, A., M.B.	London	Sanitary Officer, Southern Area, Eastern Command	b.
Holyoake, R.	Colchester	Company Officer	—
Hayes, J. P. S.	Dover	.. ..	—
Horrocks, W. H., M.B.	Gibraltar	Sanitary Officer	b.
Hale, C. H., D.S.O.	Rangoon, India	Officer in charge Military Hospital	—
Hinde, A. B.	.. ..	.. ..	—
Hore, H. St. G. S.	Birr	Officer in charge Military Hospital	—
Holt, M. P. C., D.S.O.	Dublin	.. ..	j.
Hassard, E. M.	Jamaica	Officer in charge Military Hospital at Up Park Camp	—
Hallaran, W., M.B.	Ferozepore, India	In charge Cantonment Hospital	—
Healey, C. W. R.	Dublin	.. ..	—
Hardy, F. W., M.B.	Cairo, Egypt	Sanitary Officer	b.
Healy, C. J., M.B.	Colombo, Ceylon	Officer in charge Military Hospital	—
Hardy, W. E.	Shorncliffe	.. ..	—
Hennessy, J., M.B.	Aden	Officer in charge Military Hospital	—
Hinge, H. A.	Aldershot	Officer Comdg. "B" Company, Depôt, R.A.M.C.	—
Hodgens, C. O'C.	Up Park Camp, Jamaica	.. ..	—
Innis, B. J.	Lucknow, India	.. ..	—
Jones, F. W. C., M.B.	Nasirabad, India	Officer in charge Military Hospital	—
Josling, C. L.	Hong Kong, S. China	Officer in charge Military Hospital, Victoria	—
Julian, O. R. A., C.M.G.	Chatham	Anæsthetist	b.
Jackson, R. W. H., M.B.	Cork	Sanitary Officer	b.
Jennings, J. W., D.S.O.	India	.. ..	o.
Jameson, J. C., M.B.	Royal Arsenal, Woolwich	.. ..	b.
Johnson, H. P.	Bareilly, India	.. ..	—
Jones, T. P., M.B.	Woolwich	Adjutant Woolwich Coy., R.A.M.C. (Volunteers)	—
Kearney, J., M. D.	Wrexham	Officer in charge Military Hospital	—
Kennedy, A.	Poona, India	.. ..	—
Knaggs, H. T., M.B.	Dublin	In charge Staff and Depts., North	—
Kelly, J. F. M., M.B.	Returning to England, tour expired	.. ..	—
Keble, A. E. C.	Chatham	In charge Military Families Hosp.	h.
Lane, C. A., M.B.	Trincomali, Ceylon	Officer in charge Military Hospital	—
Lavie, T. G.	Bellary, India	.. ..	—
Le Quesne, F. S., V.C.	Lucknow, India	.. ..	—
Leishman, W. B., M.B.	London	R.A.M. College	—
Luther, A. J.	Delhi, India	Officer in charge Military Hospital	—
Lenehan, T. J., M.B.	Middleburg, C. C., S. Africa	Company Officer	—
Lawson, C.B., M.B.	Valetta, Malta	Bacteriologist and Anæsthetist	o.
Lewis, R. C.	Ranikhet, India	In charge Cantonment Hospital, Staff Surgeon and Civil Surgeon	—
Longhurst, B. W.	Cyprus	Officer in charge Military Hospital	d.
Melville, C. H., M.B.	Wellington, India	Sanitary Officer Madras Command	b.
Mills, B. L., M.D.	Poona, India	Staff Officer, Army Bearer Corps, Western Command	b.
Moir, J., M.B.	Landguard	Officer in charge Military Hospital	—
MacDonald, C. J., M.D.	Fermoy	Anæsthetist and in charge Officers, Women and Children	—
Mathias, H. B., D.S.O.	Campbellpore, India	Officer in charge Military Hospital and Cantonment Hospital	—

Name.	Station.	Appointment.	Specialist Certificates in.
Marder, E. S.	Canterbury	..	—
Marks, G. F. H., M.D.	Sitapur, India	Officer in charge Military Hospital and Cantonment Hospital	—
Morgan, F. J.	Ambala, India	In charge Cantonment Hospital	—
McCulloch, T., M.B.	War Office, London	Headquarter Staff	—
Macdonald, S., M.B.	Woolwich	..	—
Morgan, J. C.	Calcutta, India	In charge District Laboratory	b.
Mould, W. T.	Fatehgar, India	Officer in charge Military Hospital and Gun Carriage Factory	—
McLoughlin, G. S., M.B., D.S.O.	Sierra Leone, W. Africa	Officer in charge Military Hospital, Mount Auriol	—
Mawhinny, R. J. W.	Multan, India	Staff Surgeon	—
McDowell, F.	Peshawar, India	..	—
MacCarthy, I. A. O.	Kilkenny	Officer in charge Military Hospital	—
Mason, H. D.	Allahabad, India	..	—
Morphew, E. M.	Returning to England, tour expired		—
Mitchell, L. A., M.B.	Jubbulpore, India	Officer in charge Cantonment Hosp.	—
Martin, C. B., M.B.	Netley	Assistant Secretary and Registrar	—
McNaught, J. G., M.D.	Edinburgh	Sanitary Officer	b.
McDermott, T., M.B.	Calcutta, India	..	k.
More, L. P., M.B.	Bareilly, India	..	—
Moore, G. A., M.D.	Warley	..	g.
Marder, N.	Netley	..	—
Meek, J., M.D.	Tower of London	Officer in charge Military Hospital	—
Morris, A. E., M.D.	Woolwich	..	—
Mansfield, G. S., M.B.	Rochester Row, London	..	—
Mangin, F. M.	Jamaica	..	k.
Molesworth, R. E.	Ranikhet, India	..	—
Macleod, R. L. R., M.B.	Dublin	Sanitary Officer	b.
Maturin, B. A.	Woolwich	..	—
Nicolls, J. M.	Forrest, Malta	Officer in charge Military Hospital	—
Nash, L. T. M.	Portsmouth	..	—
Newland, F. R., M.B.	Hyderabad, India	Officer in charge Military Hospital	—
O'Halloran, M., M.D.	Harrismith, S. Africa	..	—
O'Donnell, J. J., M.B.	Leeds	Officer in charge Military Hospital	—
O'Callaghan, D. M.	Bedford	..	—
O'Reilly, H. W. H., M.B.	Wynberg, S. Africa	Anæsthetist and Company Officer	—
Penton, R. H., D.S.O.	Southern Comd., England	..	—
Poole, W. C., M.B.	Saugor, India	Officer in charge Military Hospital and Cantonment Hospital	—
Pocock, H. J.	Aldershot	In charge 4th Brigade	—
Paterson, J., M.B.	Watford, Bermuda	Officer in charge Military Hospital and Army Medical Stores	—
Peeke, H. S.	Aldershot	Company Officer No. 1 Company	—
Parry, H. J., M.B., D.S.O.	Aldershot	Officer Comdg. "A" Company, Depôt, R.A.M.C.	—
Powell, E. E.	Gibraltar	In charge Moorish Castle and Poca Roca	—
Pearse, A.	Welsh and Mid. Command	Sanitary Officer	b.
Porter, F. J. W., D.S.O.	Colchester	..	—
Pilcher, E. M., M.D., D.S.O.	Royal Arsenal, Woolwich	..	—
Pollock, C. E.	Malta	..	e.o.
Powell, S., M.B.	Aldershot	Officer in charge Louise Margaret Hospital	—
Power, R. I.	Ballincollig	Officer in charge Military Hospital	—
Philson, S. C.	Roorkee, India	,, ,, ,, ,,	—
Pinches, W. H.	Shorncliffe	In charge Recruiting	—
Rowan, H. D., M.B.	Mian Mir, India	..	—
Russell, J. J., M.B.	Rawalpindi, India	Staff Surgeon	—
Raymond, G., M.B.	Bangalore, India	In charge District Laboratory	b.
Reily, A. Y., M.B.	Maymyo, India	..	—
Ritchie, J., M.B.	Tanglin, S. Setts.	Officer in charge Military Hospital	—

Name.	Station.	Appointment.	Specialist Certificates in.
Rawnsley, G. T.	Portsmouth	In charge Effective Troops ..	—
Reilly, C. W.	Dublin	Officer in charge Military Hospital, Arbor Hill	—
Robinson, O. L.	Gibraltar	In charge Windmill Hill, Buena Vista and Military Prison	—
Read, H. W. K.	India	.. ..	—
Rivers, J. H.	Attached Egyptian Army	.. ..	o.
Sexton, M. J., M.D. ..	Muttra, India	Officer in charge Military Hospital	—
Starr, W. H.	Dover	Officer in charge Section Hospital, Dover Castle	—
Sutton, A. A., D.S.O. ..	.. ..	.. ..	—
Saw, F. A., M.D. ..	Secunderbad, India ..	.. ..	b.
Squire, W. P.	Chatham	Officer in charge Military Hospital	—
Salvage, J. V., M.D. ..	Tidworth	Sanitary Officer, Eastern Area, Southern Command	b.
Saunders, D. M., M.D. ..	Dublin	Assistant to Principal Medical Officer, Irish Command	b.
Scott, G., M.B.	Multan, India	.. ..	—
Scott, B. H.	Rawalpindi, India ..	Sanitary Officer, Northern Command	b.
Stiell, D., M.D.	Thayetmyo, India ..	Officer in charge Military Hospital	—
Salmon, L. E. A.	Southern Command, England	.. ..	—
Stone, C. A., M.D. ..	Dover	In charge Officers, Women and Children	—
Smith, F., D.S.O. ..	.. ..	.. ..	b.
Smithson, A. E., M.B. ..	Middleburg, C.C., S. Africa	Anæthetist	b.
Shanahan, D. D.	Tipperary	Officer in charge Military Hospital	—
Samman, C. T.	Jamaica	Officer in charge Military Hospital, Newcastle	n.b.
Stalkartt, C. E. G., M.D.	St. Helena	Officer in charge Military Hospital, Women and Children, and Senior Medical Officer	—
Stanistreet, G. B., M.B. ..	Cairo, Egypt	Company Officer	—
Spencer, C. G., M.B. ..	Curragh	Operating Surgeon..	j.
Stalkartt, H. A., M.B. ..	Kailana, India	.. ..	—
Slayter, E. W., M.B. ..	Naini Tal, India	Officer in charge Military Hospital and in charge Headquarter Staff and Establishment	—
Symons, F. A., M.B. ..	Jubbulpore, India ..	.. ..	—
Swan, W. T., M.B. ..	Jullundur, India	.. ..	—
Shine, J. M. F., M.D. ..	Dublin	.. ..	—
Sparkes, C. S.	Kowloon, Hong Kong ..	Officer in charge Military Hospital	—
Tatham, C. J. W.	Devonport	Sanitary Officer, Western Area, Western Command	b.
Trotter, W. J.	Citta Vecchia, Malta ..	Officer in charge Sanatorium ..	—
Thurston, H. C., C.M.G. ..	War Office, London ..	Headquarter Staff	—
Thacker, R. C.	Jhansi, India	Officer in charge Military Hospital	—
Thomson, J., M.B. ..	Edinburgh	.. ..	—
Tate, G. W., M.B. ..	Barberton, S. Africa ..	Officer in charge Military Hospital	—
Tyacke, N.	Jutogh, India	Officer in charge Military Hospital and Cantonment Hospital	—
Thurston, H. S.	N. China	.. ..	—
Tyrrell, A. F.	Gibraltar	.. ..	—
Thompson, A. G., M.B. ..	.. ..	.. ..	—
Taylor, W. J., M.B. ..	Neemuch, India	In Medical charge, Station Staff, and Agency Surgeon	o.
Wills, S. R.	Pietermaritzburg, S. Africa	Officer in charge Military Hospital and Senior Med. Officer, Natal	—
Wilson, J. B., M.D. ..	Cairo, Egypt	Officer in charge Abbassiyeh ..	—
Will, J., M.B.	(Seconded Colonial Govt.)	.. ..	—
Wright, R. W.	Portsmouth	Company Officer	—
Whitty, M. J., M.D. ..	Cahir	Officer in charge Military Hospital	—

Name.	Station.	Appointment.	Specialist Certificates in.
Windle, R. J., M.B. ..	Dublin	In charge Staff and Depts., South	—
Watson, J. J., M.D., C.I.E.	St. George's, Bermuda ..	Officer in charge Military Hospital	—
Whaite, T. Du B., M.B...	Gibraltar	.. ..	—
Watson, A. O. C., M.B. ..	Aberdeen	Officer in charge Military Hospital	b.
Wade, G. A., M.D. ..	Dorchester	,, ,, ,, ,,	b.
Weir, J. C., M.B.	London	Sanitary Officer London District	b.
Wright, A...	Halifax, N.S.	Officer in charge Military Hospital	—
Winter, H. E.	India	.. ..	—
Way, L.	Meerut, India	Officer in charge Military Hospital	—
Williams, E. McK. ..	Guildford	,, ,, ,, ,,	—
Whitestone, C. W. H., M.B.	Eastern Com., England	.. ..	—
Wade-Brown, F. J. ..	Gosport	.. ..	—
Withers, S. H., M.B. ..	Benares, India	Officer in charge Military Hospital	—
Yarr, M. T.	India	Staff of Governor of Bombay ..	—
Young, C. A.	Enniskillen	Officer in charge Military Hospital	—

CAPTAINS.

Ashe, F.	Returning to England, .. tour expired	.. ..	—
Adye-Curran, S. M. ..	St. Lucia, W.I.	In charge Officers, Women and Children at Vigie	—
Anderson, H. S.	London	R.A.M. College	—
Adye-Curran, W. J. P. ..	Dublin	.. ..	—
Argles, R. L.	Bulford	.. ..	—
Adderley, A. C.	Secunderabad, India ..	.. ..	—
Aylen, E. V.	Wei-hai-Wei, N. China ..	.. ..	—
Archer, S. A.	Belfast	.. ..	—
Addams-Williams, L. ..	Standerton, S. Africa ..	Sanitary Officer and Anæsthetist,	—
Archer, G. J. S., M.B. ..	Returning to England, tour expired	.. ..	—
Bransbury, H. A... ..	Kandia, Crete	.. ..	—
Black, R. B., M.B. ..	Attached Egyptian Army	.. ..	—
Barbour, J. H., M.B. ..	Halifax, N.S.	Sanitary Charge, Citadel	—
Bostock, J. S., M.B. ..	Malta	In charge Troops, St. Francis Barracks	—
Beatty, M. C., M.B. ..	Mhow, India	In charge District Laboratory ..	—
Brodribb, E.	Gibraltar	.. ..	—
Barrow, H. P. W... ..	Ambala, India	.. ..	—
Brakenridge, F. J. ..	Attached Egyptian Army	.. ..	b.
Blackwell, W. R... ..	R.A.M. College	.. ..	—
Butler, S. G.	Fort Tregantle	Officer in charge Military Hospital	—
Bond, J. H. R.	Returning to England, tour expired	.. ..	—
Babington, M. H. ..	R.A.M. College	.. ..	—
Buist, James M., M.B. ..	Transvaal, S. Africa ..	.. ..	—
Biggam, T., M.B... ..	Poona, India	.. ..	—
Baker, W. L.	Meiktila, India	.. ..	—
Bennett, W., M.B. ..	Lucknow, India	.. ..	—
Bartlett, B. S.	Delhi, India	.. ..	—
Bennett, E.	Bloemfontein, S. Africa ..	.. ..	..
Brown, R. T., M.D. ..	Lucknow, India	Staff Surgeon, in charge District Laboratory	b.
Bennett, W. L., M.B. ..	Jullundur, India	.. ..	—
Burke, B. B.	Rawalpindi, India ..	.. ..	—
Baillie, G., M.B.	Quetta, India	.. ..	—
Bodington, P. J., M.B. ..	London District	.. ..	—
Brunskill, J. H., M.B. ..	India	.. ..	—
Bateman, H. R.	Valetta, Malta	.. ..	—

Name.	Station.	Appointment.	Specialist Certificates in.
Barnett, K. B., M.B.	N. China	..	m.
Boyle, M., M.B.	Shwebo, India	Officer in charge Military Hospital	o.
Buist, John M., M.B.	Pretoria, S. Africa	..	b. c.
Blackham, R. J.	Bulford	..	h.
Bliss, E. W.	Sierra Leone, W. Africa	Officer in charge Military Hospital at Mabanta	j.
Birrell, E. T. F., M.B.	Rawalpindi, India	Personal Assistant to Principal Med. Offi., Northern Command	—
Bowen, A. W. N.	Woolwich	..	—
Browne-Mason, H. O. B.	Returning to England, tour expired	..	—
Berne, J. G.	Purandhar, India	Officer in charge Military Hospital	g.
Bourke, E. A.	Londonderry	,, ,, ,, ,,	b. f.
Clark, E. S., M.B.	Peshawar, India	..	f.
Cameron, K. M., M.B.	Ambala, India	..	j.
Campbell, J. H., D.S.O.	Colchester	In charge Military Families Hosp.	h.
Cochrane, E. W. W., M.B.	West Africa	..	c.
Clements, R. W., M.B.	Manchester	Adjutant Manchester Companies R.A.M.C. (Volunteers)	o.
Corkery, M. P.	Meerut, India	Staff Surgeon	—
Clarke, T. H. M., M.B., C.M.G., D.S.O.	Colchester	..	—
Cummins, S. L., M.B.	Attached Egyptian Army	..	—
Carroll, F. F., M.B.	Devonport	..	j.
Carter, G. B., M.B.	Madras, India	..	—
Cowan, J., M.B.	Netley	..	—
Curme, D. E.	Thayetmyo, India	..	—
Cunningham, R. A., M.B.	Returning to England, tour expired	..	—
Chopping, A.	Windsor	In charge Women and Children	—
Crawford, V. J.	Cork	..	—
Connolly, E. P.	R.A.M. College	..	—
Crean, T. J., V.C.	..	..	—
Cumming, C. C., M.B.	Peshawar	..	—
Carylon, A. F.	Southern Command, England	..	—
Cato, C. S.	Chester	..	—
Croly, W. C.	Secunderabad, India	..	—
Cotton, F. W.	Nowshera, India	..	—
Carroll, G.	Sitapur, India	..	—
Churton, J. G.	Nowgong, India	..	—
Cuthbert, J. M., M.B.	Agra, India	In charge District Laboratory	—
Carr, C. H., M.D.	Hyderabad, India	..	—
Crosthwait, W. S.	Calicut, India	..	—
Cautley, J. B.	Roorkee, India	..	—
Challis, O.	Malta	..	—
Cowie, R. V.	Bangalore, India	..	—
Conway, J.	Lucknow, India	..	—
Clarke, J. B., M.B.	Meerut, India	..	—
Cotterill, L.	Secunderabad, India	..	—
Collingwood, P. H.	Ashton-under-Lyne	Officer in charge Military Hospital	—
Crisp, G. B.	R.A.M. College	..	—
Craig, B. A.	Hong Kong, S. China	In charge H. S. Meeanee	—
Dansey-Browning, G.	Attached Egyptian Army	..	b.
Delap, G. G., D.S.O.	Returning to England, tour expired	..	—
Douglas, H. E. M., V.C., D.S.O.	Mian Mir, India	..	b.
Dorgan, J., M.B.	Poona, India	In charge Cantonment Hospital	—
Dinnis, B.R., M.D.	Secunderabad, India	In charge District Laboratory	—
Douglass, P. C.	Mhow, India	..	—
Duffey, A. C., M.D.	Pretoria, S. Africa	..	—
Davidson, H. A., M.B.	St. Thomas's Mount, India	..	b.
Davis, W.	Meerut, India	..	—

Name.	Station.	Appointment.	Specialist Certificates in.
Ellery, E. E.	Returning to England, tour expired	..	—
Elsner, O. W. A.	R.A.M. College	..	—
Ensor, H., M.B., D.S.O.	Attached Egyptian Army	..	—
Evans, C. R.	Khandalla, India	Officer in charge Military Hospital	—
Ellery, R. F.	Allahabad, India	..	—
Evans, P., M.B.	Aldershot	Company Officer, No. 2 Company	b. f. j.
Fell, M. H. G.	R.A.M. College	..	—
Falkner, P. H.	Dublin	Anæsthetist	—
Foster, J. G., M.B.	Port Louis, Mauritius	Officer in charge Military Hospital	—
Ford, E. G., M.B.	Malta	In charge troops, Fort Ricasoli	—
Fawcus, H. B., M.B.	Gibraltar	..	—
Fielding, T. E., M.B.	Jamaica	..	—
Furnivall, C. H.	Quetta, India	In charge District Laboratory	—
Fitzgerald, Fitz G. G.	Curragh	Anæsthetist, Company Officer, and Instructor	—
Fry, W. B.	Rawalpindi, India	..	—
Fleming, C. E., M.B.	St. Lucia, W.I.	In charge Officers, Women and Children at the "Morne"	—
Fawcett, R. F. M.	Halifax, N.S.	Sanitary Charge, Wellington and Glacis Barracks	—
Falkner, M. W.	Muttra, India	..	—
Foulds, M. F.	Saugor, India	..	—
Ffrench, E. G., M.B.	Jamaica	In charge Officers, Women and Children, Military Prison, and A. M. Stores	—
French, H. C.	Cyprus	..	e. b.
Fleury, C. M.	Malta	..	o.
Fox, A. C.	..	..	h.
Fairrie, S. H.	Shorncliffe	Officer in charge Military Families Hospital, and Anæsthetist	h.
Forrest, J. V., M.B.	Tower Hill, W. Africa	..	—
Fuhr, R. S. H., D.S.O.	Murree, India	Officer in Charge Headqr. Staff	—
Gallie, J. S.	Bordon	Officer in charge Detention Hosp.	—
Gill, J. G.	Aldershot	..	—
Goddard, G. H.	Bloemfontein	In charge Female Hospital and Military Prison	—
Goldsmith, G. M., M.B.	Dublin	..	—
Greenwood, A. R.	Secunderabad, India	..	—
Goodwin, W. R. P.	Rawalpindi, India	..	—
Gibson, A. W.	Deolali, India	Offi. in charge Cantonment Hosp.	—
Green, S. F. St. D.	Prospect, Bermuda	In charge Staff and Departments, Officers, Women, and Children	h.
Grattan, H. W.	Sierra Leone, W. Africa	Sanitary Officer	b. c.
Gunter, F. E., M.B.	R.A.M. College	..	—
Grech, J.	Dinapore, India	Specialist in Skiagraphy for Eastern Command	o.
Gwynn, W. P.	Devonport	..	—
Hewetson, H.	Dover	Company Officer	a. b.
Hudleston, W. E.	Kamptee, India	..	b. f.
Hopkins, C. H.	Bombay, India	..	f.
Hall, S. O.	Madras, India	..	h.
Heffernan, F. J. C.	York	Company Officer	—
Herrick, H.	R.A.M. College	..	—
Hewitt, E. P.	St. George's, Bermuda	In charge Staff and Departments, Officers, Women and Children	—
Houghton, J. W. H., M.B.	R.A.M. College	..	b.
Harvey, D., M.B.	R.A.M. College	..	—
Humphrey, L.	Dublin	..	—
Harrison, L. W., M.B.	Sialkot, India	..	—
Harvey, F.	R.A.M. College	..	—
Hime, H. C. R., M.B.	R.A.M. College	..	—
Hartigan, J. A., M.B.	Peshawar, India	..	—

Name.	Station.	Appointment.	Specialist Certificates in.
Hyde, D. O., M.B.	Karachi, India	.. ..	—
Hamerton, A. E., D.S.O.	Ferozepore, India	.. ..	—
Houghton, G. J.	Calcutta, India	Staff Surgeon	—
Henderson, P. H., M.B.	Ahmednagar, India	In charge Cantonment Hospital	—
Hardy, F. H.	Alton	.. ..	—
Hunt, R. N., M.B.	Secunderabad, India	.. ..	—
Howley, H. E. J. A.	Warwick Camp, Bermuda	In charge Troops	—
Hull, A. J.	Jhansi, India	In charge Cantonment Hospital	—
Harding, D. L.	Secunderabad, India	.. ..	—
Hodgson, J. E.	Calcutta, India	.. ..	—
Hyde, P. G., M.B.	Bareilly, India	.. ..	—
Harrison, W. S., M.B.	Aldershot	.. ..	c.
Howell, H. A. L.	Chatham	Company Officer	f.
Hayes, E. C.	Rochester Row, London	.. ..	k.
Hooper, A. W., D.S.O.	Poona, India	.. ..	—
Harvey, W. J. S.	Hong Kong, S. China	.. ..	—
Irvine, F. S., M.B.	Aldershot	.. ..	—
Irwin, A. W. A.	Barbados	In charge Women and Children	—
Inkson, E. T., V.C.	R.A.M. College	.. ..	—
Jameson, A. D.	Malta	.. ..	—
Johnson, J. T., M.D.	Hong Kong, S. China	In charge Lyemun Forts	—
Jones, J. L.	Colombo, Ceylon	In charge Officers and their Families	—
Knox, E. B., M.D.	Simla, India	Secretary, Principal Medical Officer, India	—
Kennedy, J. C., M.B.	Valetta, Malta	Mediterranean Fever Commission	—
Kiddle, F., M.B.	Ahmednagar, India	.. ..	k.
Lawson, D.	Netley	Anæsthetist	—
Lowsley, M. M.	Portsmouth	.. ..	—
Lupton, A. C., M.D.	York	.. ..	—
Lauder, T. C., M.B.	Dublin	.. ..	b.
Leake, J. W.	Watford, Bermuda	.. ..	—
Lloyd, L. N., D.S.O.	Winchester	.. ..	—
Lauder, F. P.	Ootocamund, India	Personal Asst. to Principal Medical Officer, Secunderabad Command	—
Lelean, P. S.	Aldershot	In charge Women and Children, Marlboro' Lines	—
L'Estrange, E. F. Q.	.. ..	.. ..	—
Lambelle, F. W., M.B.	Hong Kong, S. China	In charge Female Hosp., Victoria	—
Lloyd, R. H.	Welsh and Midland Command	.. ..	—
Langstaff, J. W.	Hulme, Manchester	Officer in charge Military Hospital	—
Mainprise, C. W.	Tidworth	.. ..	—
Morris, J. I. W.	Rochester Row, London	.. ..	—
MacKenzie, T. C., D.S.O.	.. ..	.. ..	—
Morton, H. M., M.B.	Returning to England, tour expired		—
Matthews, J.	Deepcut	Officer in charge	—
McLoughlin, W. M.	Middelburg, Transvaal	.. ..	—
MacLaughlin, A. M., M.B.	Belfast	.. ..	—
Merry, F. H., M.B.	Harrismith, S. Africa	Sanitary Officer	—
Martin, J. F., M.B.	Attock, India	Officer in charge Military Hospital	—
McDonnell, E., M.B.	Maymyo, India	Officer in charge Military Hospital and 2/10 Gurkha Rifles and Staff Surgeoncy	—
McLennan, F., M.B.	Lucknow, India	.. ..	—
Murphy, J. P. J., M.B.	Nowshera, India	.. ..	—
Myles, C. D., M.B.	Jhansi, India	.. ..	—
Mason, S. A.	Middleburg, Cape Colony, S. Africa	Sanitary Officer	—
Mitchell, A. H. McN.	Cawnpore, India	Staff Surgeon, Special Health Officer	—
McGregor, H. J., M.B.	Woolwich	.. ..	b.
McMunn, A.	Ambala, India	.. ..	—

Name.	Station.	Appointment.	Specialist Certificates in.
McMunn, J. R.	Pretoria, S. Africa	.. ..	f.
Master, A. E., M.B.	Cottonera, Malta	Company Officer	g.
Milner, A. E.	Ootacamund, India	Offg. Staff Offi. to Madras Division of the Army Bearer Corps	o.
Morgan, C. K.	Cairo, Egypt	Skiagraphist	o.
Maurice, G. T. K.	India	.. ..	m.
Morris, A. H.	Chatham	.. ..	b. c.
MacDougall, A. J., M.B.	Piershill	Officer in charge Military Hospital	c.
Marriott, E. W. P. V.	Pembroke Dock	.. ..	o.
McKessack, P., M.B.	Plymouth	Officer in charge Women and Children	
McCarthy, J. McD., M.B.	Chester	.. ..	a. b.
Martin, H. G.	Ballincollig	.. ..	h.
Macpherson, J. D. G., M.B.	Portsmouth	.. ..	—
Norman, H. H.	R.A.M. College	.. ..	—
Nicholls, H. M., M.B.	Cork	.. ..	—
Nickerson, W. H. S., V.C., M.B.	R.A.M. College	.. ..	—
Nickerson, G. S., M.B.	Attached Egyptian Army	.. ..	—
Norrington, H. L. W.	Returning to England, tour expired	.. ..	—
O'Flaherty, A. R.	Mhow, India	Consulting Surgeon R.M. Ry.	—
Ormsby, G. J. A., M.D.	Dublin	Company Officer	—
O'Reilly, P. S.	Quetta, India	In charge Station Staff	—
Odlum, W. H.	Nasirabad, India	In charge Cantonment Hospital	—
O'Donoghue, D. J. F.	Belgaum, India	.. ..	—
O'Grady, S. de C., M.B.	Limerick	.. ..	a.
O'Gorman, C. J., D.S.O.	R.A.M. College	.. ..	—
Prynne, H. V.	Woolwich	Ophthalmologist, Royal Herbert Hospital	k.
Profeit, C. W., M.B.	Dagshai, India	.. ..	g.
Perry, S. J. C. P.	Wilberforce, W. Africa	Officer in charge Military Hospital	o.
Probyn, P. J., D.S.O.	R.A.M. College	.. ..	—
Phillips, R. E. G.	R.A.M. College	.. ..	—
Poe, J., M.B.	Newbridge	Officer in charge Military Hospital	—
Penny, F. S.	Lucknow, India	.. ..	—
Parker, L. E. L.	R.A.M. College	.. ..	—
Packer, H. D.	Cork	.. ..	—
Palmer, F. J.	R.A.M. College	.. ..	-
Prescott, J. J. W., D.S.O.	Devonport	.. ..	—
Parry, F. M., M.B.	Aden	.. ..	—
Powell, J., M.B.	Rawalpindi, India	.. ..	—
Purser, L. M., M.B.	Diyatalawa, Ceylon	Officer in charge Military Hospital	—
Popham, R. L.	Victoria, B.C.	,, ,, ,, ,,	—
Power, W. M.	Poona, India	.. ..	—
Pinches, H. G.	Lucknow, India	.. ..	—
Parsons, A. R. C.	Ghain Tufficha, Malta	Officer in charge N. D. Hospital	—
Powell, E. W.	Cork	.. ..	—
Parkes, E. E., M.B.	Gibraltar	.. ..	—
Palmer, H. K.	Fermoy	.. ..	—
Potter, T. J.	Poona, India	.. ..	—
Riddick, G. B.	Aldershot	.. ..	—
Rattray, M. MacG., M.B.	Bombay, India	.. ..	—
Ross, N. H., M.B.	Canterbury	In charge Recruiting	—
Rutherford, N. J. C., M.B.	Cape Town, S. Africa	In charge Detention Hospital, and Embarking Medical Officer	—
Richards, F. G.	Aldershot	.. ..	—
Roch, H. S.	R.A.M. College	.. ..	—
Robinson, J. H.	Rawalpindi, India	.. ..	—
Ronayne, C. R. L., M.B.	Calcutta, India	.. ..	—
Riach, W., M.D.	Alexandria, Egypt	.. ..	b.
Ryan, E.	Cottonera, Malta	.. ..	—
Roche, J. V.	Fyzabad, India	In charge Cantonment Hospital	—

Name.	Station.	Appointment.	Specialist Certificates in.
Rowan Robinson, F. E., M.B.	Aden	In charge District Laboratory	—
Ritchie, T. F., M.B.	Ferozepore, India	Staff-Surgeon	—
Rogers, H., M.B.	Mian Mir, India	,, ,,	—
Scott, A. L.	Pretoria, South Africa	In charge Troops, Artillery Bks.	—
Sloan, J. M., M.B., D.S.O.	Edinburgh	Company Officer	—
Scarlett, W. W.	Returning to England, tour expired		—
Simson, H.	Pretoria, South Africa	Anæsthetist	—
Seeds, A. A., M.D.	Harrismith, South Africa	In charge Prison and Native Hospital, Company Officer and Anæsthetist	—
Siberry, E. W.	Returning to England, tour expired		—
Smith, C. S., M.B.	Woolwich		—
Safford, A. H.	Ranikhet, India		—
Sewell, E. P., M.B.	Dalhousie, India	Staff Surgeon	—
Straton, C. H.	Landour, India	,, ,,	—
Stevenson, T. H., M.B.	Fyzabad, India		—
Spiller, W. M. H., M.B.	Allahabad, India		b.
Shea, H. F., M.B.	Tidworth		—
Stephens, F. A.	Gibraltar	Anæsthetist	—
Steele, W. L.	Lucknow, India		—
Sparkes, W. M. B.	Amritsar, India	Officer in charge Military Hospital	—
Smith, S. B., M.B.	Multan, India		—
Silver, J. P., M.B.	Barbados	In charge Officers, Staff, and Departments	—
Sweetnam, S. W.	Colchester		—
Steel, E. B., M.B.	Aldershot	Officer Comdg. "C" Company, Depôt, R.A.M.C.	n.
Skinner, R. McK.	Gibraltar	In charge Grand Casemates Bks.	—
Sheehan, G. F.	Blakan Mati, S. Setts.	Officer in charge Military Hospital	—
Scott, H. H., M.B.	Pietermaritzburg, S.Africa	Company Officer and Anæsthetist	—
Sampey, A. W.	W. Africa		b.
Staddon, H. E.	Vocoas, Mauritius	In charge Effective European Troops and in charge Detention Hospital	—
Smith, L. F., M.B.	Mount Auriol, W. Africa		f.
Statham, J. C. B.	Netley	Bacteriologist	b. c.
Swabey, M.	Newcastle-on-Tyne		m.
Stammers, G. E. F.	Curepipe, Mauritius	In charge Effective Troops and Hosp. for Women and Children	—
Stallard, H. G. F.	Attached Egyptian Army		—
Selby, R., M.B.	Woolwich		—
Tibbits, W., M.B.	Barrackpore, India	In charge Cantonment Hospital	—
Thom, G. St. C., M.B.	Aldershot	Adjutant Depôt, R.A.M.C.	l.
Thorp, A. E.	R.A.M. College		—
Taylor, H. S.	Tower Hill, W. Africa	In charge Effective Troops, Women and Children	—
Tobin, J.	Indore, India	Officer in charge Military Hospital	
Thorpe, L. L. G.	Aden	No. 16/B B.F. Hospital, Dthala	
Thomson, C. G.	Dublin		—
Unwin, T. B., M.B.	Ceylon	Officer in charge Military Hospital, Kandy	—
Vaughan-Williams, H. W., M.B.	O.R. Colony, S. Africa		
Walton, H. B. G.	Barbados	In charge W. I. Regiment and Military Prison	
Winkfield, W. B.	R.A.M. College		—
Wroughton, A. O. B.	Mandalay, India		—
Woodside, W. A.	R.A.M. College		—
Webb, A. L. A.	Kirkee, India	In charge Cantonment Hospital	—
Winslow, L. F. F.	Gibraltar	In charge Europa Barracks	—
Wood, L.	Rawalpindi, India		—
Wingate, B. F.	Aldershot		—

Name.	Station.	Appointment.	Specialist Certificates in.
Waring, A. D., M.B.	Jubbulpore, India	.. ..	—
Weston, A. F.	Rawalpindi, India	.. ..	—
Waters, W. J.	Chakrata, India	.. ..	—
Whelan, J. F., M.B.	Peshawar, India	.. ..	—
West, J. W., M.B.	Bloemfontein, S. Africa	.. ..	—
White, T.	Fort Chambray, Gozo, Malta	Officer in charge Military Hospital	—
Worthington, E.S.	Agra, India	.. ..	—
Wills, A. J. W.	Poonamallee, India	.. ..	—
Woodley, R. N.	Cottonera, Malta	In charge women and children, Verdala District	—
Winder, J. H. R., M.D.	Malta	Officer in charge troops, Tigne, Manoel and Sliema Districts	—
Wilson, R. C.	Cairo, Egypt	Anæsthetist, and in charge Mena Camp	—
Williamson, A. J., M.B.	Quetta, India	.. ..	—
Williams, E. M.	Valetta, Malta	In charge Staff and Depts., Female Hospital, and Company Officer	h.
Waring, A. H.	Gosport	In charge Fort Rowner	o.
Ward, W. A.	Bangalore, India	.. ..	—
Wanhill, C. F.	Prospect, Bermuda	Sanitary Officer	b. c.
Watts, B.	York	In charge Staff and Departments	—
Weld, A. E.	Devonport	.. ..	h.
Walker, F. S.	Fort Lahore, India	.. ..	—
Young, A. H. O.	Dublin	.. ..	—

LIEUTENANTS.

Ainsworth, R. B.	Secunderabad, India	.. ..	—
Ahern, D.	Karachi, India	.. ..	—
Arthur, A. S., M.B.	Peshawar, India	.. ..	—
Anderson, R. G.	.. .. ..	On probation	—
Ahern, M. D.	Ferozepore, India	.. ..	—
Balck, C. A. J. A., M.B.	Ambala, India	.. ..	—
Bagshawe. H. V.	Rangoon, India	.. ..	—
Browne, W. W.	Wellington, India	.. ..	—
Bell, J. G., M.B.	Bangalore, India	.. ..	—
Bridges, R. H.	Bangalore, India	.. ..	—
Brown, G. H. J., M.B.	Maymyo, India	.. ..	—
Bramhall, C.	Aden	.. ..	—
Bradley, C. R.	Kamptee, India	.. ..	—
Bousfield, L., M.B.	R.A.M. College	.. ..	—
Bowle, S. C.	India	.. ..	—
Byan, W.	.. .. ..	On probation	—
Beadnell, H. O. M.	Curragh	In charge Military Prison	—
Buchanan, R. J. B.	R.A.M. College	On probation	—
Booth, E. B., M.B.	R.A.M. College	,,	—
Crossley, H. J.	Wellington, India	In charge Cantonment Hospital and Staff Surgeon	—
Clarke, F. A. H.	Chakrata, India	Staff Surgeon and in charge Cantonment Hospital	—
Conway, J. M. H.	Ambala, India	.. ..	—
Coates, T. S., M.B.	Colaba, India	.. ..	—
Carmichael, J. C. G., M.B.	St. Thomas's Mount, India	.. ..	—
Carmichael, D. G., M.B.	Rangoon, India	In charge District Laboratory	—
Crawford, J. M. M.	Mian Mir, India	.. ..	—
Collins, R. T.	India	.. ..	—
Cathcart, G. E.	Rawalpindi, India	.. ..	—

Name.	Station.	Appointment.	Specialist Certificates in.
Connell, H. B.	.. ..	Seconded with Foreign Office ..	—
Cahill, R. J., M.B. ..	Peshawar, India	.. ..	—
Campbell, J., M.B. ..	Curragh	.. ..	—
Carter, H. St. M., M.D. ..	.. ..	On probation	—
Cordner, R. H. L. ..	Aldershot	.. ..	
Churchill, G. B. F. ..	R.A.M. College	On probation	
Davidson, P., M.B., D.S.O.	Rawalpindi, India ..	.. ..	—
Dawson, F. W. W., M.B.	Middleburg, C.C., S. Africa	.. ..	
Dunbar, B. H. V. ..	Poona, India	.. ..	
Duguid, J. H., M.B. ..	Tanglin, S. Setts... ..	.. ..	
Dudding, T. S.	Bloemfontein, S. Africa ..	.. ..	
Dunkerton, N. E. ..	Dublin	.. ..	
Douglass, J. H., M.D. ..	India	.. ..	—
Dwyer, P.	Dublin	.. ..	—
Davy, P. C. T.	Aldershot	.. ..	—
Doig, K. A. C.	Bordon	In charge Troops	—
Ellis, W. F.	Multan, India	.. ..	—
Franklin, R. J.	Benares, India	.. ..	—
Fawcett, H. H. J. ..	Mooi River, South Africa	Officer in charge Military Hospital, Sanitary Officer and Anæsthetist	—
Fairbairn, J., M.B. ..	India	.. ..	—
Foster, R. L. V., M.B. ..	Egypt	.. ..	—
Fraser, A. N., M.B. ..	Curragh	.. ..	—
Frost, A. T.	Aldershot	.. ..	—
Gatt, J. E. H., M.D. ..	Pretoria, South Africa ..	.. ..	—
Gray, A. C. H., M.B. ..	Uganda, East Africa ..	Seconded with Foreign Office ..	—
Glanvill, E. M., M.B. ..	Standerton, South Africa	.. ..	
Grant, M. F.	India	.. ..	—
Garland, F. J., M.B. ..	India	.. ..	—
Gater, A. W.	Woolwich	.. ..	—
Gibbon, T. H., M.D. ..	R.A.M. College	On probation	—
Harding, N. E. J., M.B. ..	Shwebo, India	.. ..	—
Holden, C. W.	Returning to England, tour expired	.. ..	—
Harty, T. E.	Meerut, India	.. ..	—
Hughes, G. W. G. ..	.. .. ..	Attached Egyptian Army ..	—
Harvey, N. D'E., M.B. ..	Wynberg, S. Africa ..	.. ..	—
Hanafin, P. J.	Pretoria, S. Africa ..	.. ..	
Hildreth, H. C.	India	.. ..	—
Hole, R. B., M.B. ..	India	.. ..	—
Harding, H., M.B. ..	Karachi, India	.. ..	—
Hayes, G. S. C.	India	.. ..	—
Hills, W. H.	Netley	.. ..	—
Humfrey, R. E.	R.A.M. College	On probation	—
Harvey, G. A. D.	Curragh	.. ..	—
Holbrooke, C. D. M. ..	R.A.M. College	On probation	—
Hallowes, R. C., M.B. ..	Curragh	.. ..	—
Hoar, J. E.	R.A.M. College	On probation	—
Hayes, A. H.	Peshawar, India	.. ..	—
Heron, G. W.	R.A.M. College	On probation	—
Ievers, O., M.B.	St. Helena..	.. ..	—
Johnstone, D. P.	Bangalore, India	.. ..	—
Jones, P. A.	Netley	.. ..	—
Kelly, W. D. C., M.B. ..	Sialkot, India	.. ..	—
Kelly, H. B., M.B. ..	Malapuram, India ..	Officer in charge Military Hospital	—
Kempthorne, G. A. ..	Aldershot	In charge Women and Children, Stanhope Lines	—
Longley, J. A., M.B. ..	Woolwich	.. ..	—
Le Bas, D.	Bloemfontein, S. Africa ..	.. ..	—
Lewis, R. R.	India	.. ..	—
Lucas, T. C.	India	.. ..	—
Long, H. W., M.B. ..	Jullundur, India	Staff Surgeon	—
Lambert, F. C.	Pretoria, S. Africa ..	.. ..	—
Lewis, S. E., M.B. ..	Pretoria, S. Africa ..	.. ..	—

Name.	Station.	Appointment.	Specialist Certificates in.
Luxmoore, E. J. H.	Netley	..	—
Lynch, J. P.	Woolwich	..	—
Low, N.	Aldershot	..	—
Lithgow, E. G. R.	R.A.M. College	On probation	—
McKenzie, J., M.B.	Calcutta, India	..	—
Meadows, S. M. W.	Mian Mir, India	..	—
Meldon, J. B.	Wellington, India	In charge Cordite Factory	—
MacNicol, R. H., M.B.	Secunderabad, India	..	—
McEntire, J. T., M.B.	Bloemfontein, S. Africa	..	—
Mackay, G. S., M.B.	Pretoria, S. Africa	..	—
MacDowell, W. MacD.	Mhow, India	..	—
Moore, E. H. M.	Middelburg, Transvaal	..	—
Meaden, A. A.	Mhow, India	..	—
Mackenzie, J. F. C., M.B.	Netley	..	—
Maydon, W. G., M.B.	R.A.M. College	On probation	—
Millar, C. R.	Bordon	..	—
McNeight, A. A., M.B.	R.A.M. College	On probation	—
Maughan, J. St. A.	Netley	..	—
Meredith, R. G., M.B.	R.A.M. College	On probation	—
Noke, F. H.	India	..	—
Nealor, W. S.	R.A.M. College	On probation	—
Nash, R. P.	R.A.M. College	,,	—
Ommanney, F. M. M.	..	Seconded with Foreign Office	—
Osburn, A. C.	India	..	—
Ormrod, G., M.B.	R.A.M. College	On probation	—
Otway, A. L., M.B.	Curragh	..	—
O'Brien, C. W.	R.A.M. College	On probation	—
Pennefather, E. M.	Secunderabad, India	..	—
Patch, B. G.	Ambala, India	..	—
Powell, J. E.	India	..	—
Paton, D. D., M.D.	Netley	..	—
Pascoe, J. S.	R.A.M. College	On probation	—
Pallant, S. L.	Jubbulpore, India	..	—
Power, P., M.B.	R.A.M. College	On probation	—
Painton, G. R.	Deepcut	..	—
Parsons, W.	R.A.M. College	On probation	—
Reed, G. A. K. H.	Jhansi, India	..	—
Rutherford, R., M.B.	Deolali, India	..	—
Rivers, W. C.	Kamptee, India	..	b.
Ranking, R. M.	Hong Kong, S. China	..	—
Richmond, J. D., M.B.	Quetta, India	..	—
Rugg, G. F.	Attached Egyptian Army	..	—
Ryley, C.	Dublin	..	—
Russell, H. W., M.B.	Curragh	..	—
Rahilly, J. M. B., M.B.	R.A.M. College	On probation	—
Richard, G. H.	Netley	..	—
Roberts, F. E.	R.A.M. College	On probation	—
Smallman, A. B., M.B.	Lebong, India	..	—
Storrs, R.	Ambala, India	..	—
Seccombe, J. W. S.	..	..	—
Skelton, D. S.	Trincomali, Ceylon	In charge Women and Children	—
Stanley, C. V. B., M.D.	..	..	—
Swanzey, H. H.	Cawnpore, India	Staff Surgeon, in charge Departmental Followers' Hospital and Harness Factory	—
Skey, J. F.	Middelburg, Transvaal	..	—
Stack, H. T., M.B.	Lucknow, India	..	—
Sinclair, M., M.B.	Aldershot	..	—
Sidgwick, H. C., M.B.	Ewshott Camp	Officer in charge	—
Tyndale, W. F., M.B., C.M.G.	Allahabad, India	Staff Surgeon, and in charge District Laboratory	—
Tulloch, F. M. G.	..	Seconded with Foreign Office	—
Tabuteau, G. G.	R.A.M. College	On probation	—

Name.	Station.	Appointment.	Specialist Certificates in.
Turner, F. J.	Colaba, India	..	—
Thompson, R. J. C.	R.A.M. College	On probation	—
Thomson, D. S. B., M.B.	Dublin	..	—
Thomson, C. P., M.D.	R.A.M. College	On probation	—
Turner, C. H.	Aldershot	..	—
Turnbull, J. A.	Rawalpindi, India	..	—
Thurston, L. V.	Woolwich	..	—
Vaughan, W. F. H.	India	..	—
Walker, N. D., M.B.	Quetta, India	..	—
Webb, H. G. S.	Peshawar, India	..	—
Winder, M. G.	Potchefstroom, S. Africa	..	—
Wood, A. E. B., M.B.	Fyzabad, India	..	—
Webster, J. A. W.	Secunderabad, India	In charge Cantonment Dispensary Trimulgherry & Military Prison	—
Wilmot, R. C.	Rangoon, India	In charge Followers' Hospital, and Staff Surgeon	—
Watson, D. P., M.B.	Bangalore, India	..	—
Wetherell, M. C., M.B.	Rawalpindi, India	..	—
Whitehead, E. C., M.B.	Aldershot	..	—
Wiley, W., M.B.	India	..	—
Wright, T. J.	India	..	b.
Wilson, H. T.	Netley	..	—
Winckworth, H. C.	Netley	..	—
Wallace, G. S., M.B.	R.A.M. College	On probation	—

MEDICAL OFFICERS OF THE HOUSEHOLD CAVALRY.

Rank.	Name.	Regiment.	Station.	Specialist Certificates in.
Surg.-Lieutenant-Colonel	Deeble, B. W. C.	1st Life Guards	Regent's Park	—
Surgeon-Major	Power, J. H.	2nd ,, ,,	Hyde Park	—
,, ,,	Rayner, H., M.B.	Royal Horse Guards	Windsor	—
Surgeon-Captain	Cowie, R. M.	2nd Life Guards	Hyde Park	—
,, ,,	Killery, St. J. B.	Royal Horse Guards	Windsor	—
,, ,,	Pares, B.	1st Life Guards	Regent's Park	—

MEDICAL OFFICERS OF THE BRIGADE OF GUARDS.

Rank.	Name.	Regiment.	Station.	Specialist Certificates in.
Brig.-Surg.-Lieut.-Col.	Harrison, C. E., M.B.	Grenadier Guards	London	—
Surg.-Lieutenant-Colonel	Crooke-Lawless, W. R., M.D.	Coldstream Guards	,,	—
Surgeon-Major	Bateson, J. F., M.B.	,, ,,	Windsor	—
,, ,,	Kilkelly, C. R., M.B., C.M.G.	Grenadier Guards	Caterham	b.
,, ,,	Moores, S. G.	Scots Guards	Aldershot	b.
,, ,,	Sheldrake, E. N.	Grenadier Guards	London	—
,, ,,	Whiston, P. H.	Irish Guards	Aldershot	b.

QUARTERMASTERS.

Rank.	Name.	Dates of — Birth.	Dates of — Promotion to present rank.	Present Station.	Date went abroad or arrived home.
Major ..	Merritt, G. ..	23 6 1856	10 7 1889	S. Africa ..	24 12 1904
			Hon. Major 10 7 1904		
,, ..	Beach, J. H. W. ..	9 9 1857	8 1 1890	London ..	2 5 1903
			,, ,, 8 1 1900		
Captain	Bond, T.	24 12 1853	30 7 1890	Portsmouth ..	30 5 1902
			Hon. Capt. 30 7 1900		
,, ..	Thowless, E. ..	5 4 1851	24 12 1890	Woolwich ..	7 12 1902
			,, ,, 24 12 1900		
,, ..	Hirst, J.	23 2 1856	4 2 1891	Portsmouth ..	31 8 1902
			,, ,, 4 2 1901		
,, ..	Hewitt, M. ..	26 7 1850	22 4 1891	Curragh ..	29 11 1903
			,, ,, 22 4 1901		
,, ..	Goater, B... ..	9 10 1854	23 12 1891	Chester ..	5 7 1903
			,, ,, 23 12 1901		
,, ..	Lockhart, H. ..	6 8 1853	16 3 1892	Dublin ..	24 5 1903
			,, ,, 16 3 1902		
,, ..	Bere, C.	1 2 1852	11 1 1893	London ..	10 10 1902
			,, ,, 11 1 1903		
,, ..	Lines, E.	16 5 1855	4 10 1893	Malta ..	9 7 1902
			,, ,, 4 10 1903		
,, ..	Crawley, C. ..	7 5 1855	8 8 1894	Egypt ..	15 5 1903
			,, ,, 8 8 1904		
,, ..	Brake, T. F. ..	18 2 1859	5 9 1894	Dublin ..	23 5 1902
			,, ,, 5 9 1904		
,, ..	Short, J. B. ..	13 2 1860	12 9 1894	S. Africa ..	21 10 1899
			,, ,, 28 11 1900		
Lieut...	Hasell, H. G. ..	23 8 1860	17 4 1895	Canterbury ..	14 12 1902
,, ..	[1]Dallas, D.	7 6 1854	17 4 1895	S. Africa ..	30 11 1899
,, ..	Mathews, J. ..	22 8 1855	25 3 1896	— ..	24 12 1904
,, ..	Finley, A.	18 3 1853	6 5 1896	Aldershot ..	9 11 1902
,, ..	Diggins, W. J. ..	26 8 1854	3 6 1896	S. Africa ..	24 12 1904
,, ..	Allen, G. L. ..	25 5 1856	9 6 1897	Malta ..	19 2 1903
Captain	Bruce, A.	4 8 1858	24 11 1897	Woolwich ..	13 2 1904
			Hon. Capt. 22 8 1902		
Lieut...	Macintosh, P. ..	12 10 1854	24 8 1898	Edinburgh ..	13 9 1902
,, ..	Hawkey, R. ..	12 9 1854	28 12 1898	Woolwich ..	16 11 1902
,, ..	Whitehorn, J. C. B.	27 2 1856	8 3 1899	Cork	24 3 1903
,, ..	Painton, G. H. ..	5 7 1855	24 6 1899	Depôt ..	10 9 1902
,, ..	[2]Brook, H. S. ..	18 7 1856	12 7 1899	S. Africa ..	22 9 1899
,, ..	Spackman, H. ..	11 6 1860	4 10 1899	Netley ..	10 12 1904
,, ..	Chalk, A. J. ..	1 3 1861	18 11 1899	Dover ..	23 11 1902
,, ..	Green, J... ..	23 12 1859	18 11 1899	Devonport ..	21 6 1902
,, ..	Talbot, W. J. C. ..	25 10 1857	18 11 1899	York	28 12 1902
,, ..	Moss, E. P. ..	11 4 1859	18 11 1899	Hong Kong ..	22 8 1903
,, ..	Essex, B. E. ..	2 6 1860	6 12 1899	Colchester ..	9 9 1902
,, ..	McClay, J. ..	20 9 1858	6 12 1899	Woolwich ..	31 1 1905
,, ..	Short, G. F. ..	5 4 1862	6 12 1899	N. China ..	8 7 1904
,, ..	Woolley, H. ..	28 1 1864	13 12 1899	Gibraltar ..	12 11 1902
,, ..	Glennon, J. ..	10 6 1859	13 12 1899	Belfast ..	4 10 1902
,, ..	Ferguson, J. ..	10 12 1859	3 1 1900	Southampton	3 3 1902
,, ..	Hall, F. W. ..	26 4 1859	3 1 1900	Aldershot ..	7 12 1902
,, ..	Morrison, A. ..	16 5 1860	3 1 1900	S. Africa ..	22 9 1904
,, ..	Attwood, J. ..	16 12 1862	24 1 1900	Salisbury Plain	13 12 1902
,, ..	Duncan, W. ..	22 4 1859	24 1 1900	Netley ..	18 9 1902
,, ..	Roberts, R. O. ..	12 9 1858	24 1 1900	S. Africa ..	24 12 1904

[1] Seconded with S. African Constabulary. [2] Seconded with Transvaal Medical Staff.

Rank.	Name.	Dates of Birth.	Dates of Promotion to present rank.	Present Station.	Date went abroad or arrived home.
Lieut. ..	[1]Bruce, F.	29 1 1859	3 2 1900	Dublin ..	19 11 1900
,, ..	Holway, W. G. ..	8 11 1859	3 2 1900	S. Africa ..	22 9 1904
,, ..	Offord, E. P. ..	3 5 1862	3 2 1900	Gosport ..	9 9 1902
,, ..	Andus, H. J. F. ..	17 6 1860	3 2 1900	Alton.. ..	11 3 1900
,, ..	Conolly, J. B. ..	7 8 1864	7 3 1900	Netley ..	10 9 1902
,, ..	Houghton, E. ..	17 6 1859	17 3 1900	Dublin ..	7 12 1902
,, ..	Scott, R.	5 11 1859	17 3 1900	Malta ..	15 10 1902
,, ..	Wilson, A.	15 9 1864	17 3 1900	Hong Kong ..	2 11 1904
,, ..	Glover, H. W. ..	10 2 1860	17 3 1900	Aldershot ..	6 5 1901
,, ..	Exton, T... ..	11 8 1860	23 5 1900	,, ..	30 8 1902
Captain	Crookes, F. ..	26 11 1861	23 5 1900	Devonport ..	10 12 1904
			Hon. Capt. 29 11 1900		
Lieut. ..	Cowan, R. R. ..	29 5 1862	30 5 1900	Dover ..	19 12 1903
,, ..	Benson, G. A. ..	19 12 1862	2 6 1900	S. Africa ..	6 2 1901
,, ..	Jacomb, T. J. ..	16 4 1861	2 6 1900	Chatham ..	18 3 1902
,, ..	Wakefield, H. P. ..	11 2 1862	23 6 1900	S. Africa ..	23 6 1900
,, ..	Wheeler, A. ..	1 4 1862	26 6 1900	Depôt ..	10 2 1905
,, ..	Pilgrim, A. J. ..	23 6 1860	15 8 1900	London ..	31 8 1902
,, ..	Lunney, A. ..	7 1 1864	16 2 1901	Portsmouth ..	10 2 1905
,, ..	Clapshaw, A. ..	3 9 1859	13 3 1901	York	2 10 1902
,, ..	Archibald, W. N. ..	8 9 1861	13 3 1901	Egypt ..	9 4 1903
,, ..	Watkins, J. ..	29 5 1860	13 3 1901	S. Africa ..	1 5 1901
,, ..	Gillman, J. ..	28 11 1862	11 1 1902	,, ..	11 1 1902
,, ..	Cope, T. F. ..	14 11 1861	11 1 1902	,, ..	11 1 1902

[1] Specialist Certificate in Skiagraphy.

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RESEARCHES ON MALARIA.

BY MAJOR RONALD ROSS, C.B., F.R.S., D.Sc.
Indian Medical Service (R).

(*Continued from p.* 474.)

(12) *The Sigur Ghat:* 1897.—I arrived at Ootacamund, the great hill station of the Nilgherry Hills, at the beginning of April, 1896. This station, which is about 8,000 feet above sea-level, is surrounded by numerous tea and coffee plantations, scattered here and there in the rich valleys of the hills, and even for some distance out on the plains which encompass the hills like a sea. After enquiry it was determined to begin the investigation in the Sigur Ghat, a long natural trench which cuts at one stroke from the Ootacamund plateau right down to the plain, and which had the worst reputation for malaria. *A dâk bungalow* (rest house) and a small plantation existed near the top of the trench, at a place called Kalhutti, about 5,500 feet above sea-level; and owing to the fact that a single night spent lower down the valley was thought enough to ensure a bad, and perhaps fatal, attack, I determined to lodge here and visit the lower valley only during the day time. Nevertheless, even at Kalhutti I found almost everyone suffering from fever—which was ascribed to miasmata floating up the ravine from the plains below ; and I had been there only a few days and had paid only one diurnal visit to the plain when I myself suffered a bad

attack of æstivo-autumnal infection, the diagnosis being confirmed by the microscope.[1]

After two weeks' energetic treatment with quinine I was well enough to resume operations; and this time went direct to the plantations at the foot of the Sigur Ghat. The owner of one of them, Mr. Kindersley, wise enough to reside in the hills during the intensely malarious season of the year, very kindly placed his house in the plantation at my disposal, so that I was able to make a thorough survey of the locality. Both plantations are situated in the midst of luxurious forest and undergrowth close under the declivities of the mountains, and are copiously watered by irrigation channels. Almost all the native *employés*, as well as some families of aborigines, were suffering from severe malaria—anæmia, emaciation and enlarged spleen, and the parasites were easily found in the blood of some of them. But I was not a little astonished when I discovered that mosquitoes appeared to be almost absent in all the houses. In spite of considerable rewards which were offered for their capture, and in spite of the efforts of my trained servants and myself, scarcely any were secured. I was informed indeed by some of the *employés* that they were often bitten at night by insects which escaped in the morning; but these nocturnal visitors were not procurable.[2] Later, however, we were told of some insects which haunted the jungle and bit in the day time under the trees. I found these to be a small kind of brindled mosquito, and strongly suspected that they might be the culpable species, and accordingly examined them closely and called them *Culex silvestris*.

A part of my mission here was to enquire whether the mosquitoes in this highly malarious spot did not contain parasites which were not contained in the mosquitoes of the less malarious Bangalore. If they did so these parasites might reasonably be suspected of being the mosquito stage of the malaria parasite, and the question could subsequently be tested by experiment. These

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[1] This case was remarkable for the brevity of its incubation period. I had never suffered before from malaria, and was not likely to have acquired the infection either at Bangalore or Ootacamund. I had arrived at Kalhutti at 6 p.m. on April 22nd, and my attack commenced at 10 p.m. on April 25th. I ascribed it at the time to my visit to the plain made on April 23rd; but there is now little doubt that the infection was acquired at Kalhutti itself, which was swarming with mosquitoes, and where the servant of the dâk bungalow and all his family were ill. At the same time I do not remember to have been bitten by mosquitoes, and said so in my published account.

[2] Judging by our present knowledge, these must have been the offenders.

mosquitoes were at once found to contain two new kinds of parasites, namely, crowds of active swarm-spores in the intestine, and secondly, clusters of spores (each cluster containing eight bright oval spores) in the ventral nervous system. A close study was made of these organisms, but they did not appear in some of the jungle mosquitoes which had been fed on patients. Strangely enough, however, a person who volunteered to swallow a number of the swarm spores in water was attacked subsequently with fever, the malaria parasites, however, not being found in his blood; but I heard afterwards that, contrary to his statements, he had had fever just previously.

It will be remembered that Manson's secondary hypothesis suggested that the motile filaments, after living for some time in the mosquito, pass from it into the water, and thence by ingestion or inhalation into man. My experience, however, tended to convince me that if such infection of water takes place at all it must be very limited—in other words, that after their escape from the dead mosquito, the organisms can neither travel far in the water nor live long there. For if they could do this, almost all water in India would be infected, and the disease would be universal, instead of being confined, as it is, to certain spots. For the same reason the miasmatic theory never appealed strongly to me. I thought it most likely that men became infected from small stores of drinking water such as wells, cisterns, and even pots and ewers, into which infected mosquitoes often fall and die while laying their eggs—a theory which would easily account for the isolation of the malady, because, as I had observed over and over again, mosquitoes seldom wander far from their haunts. As, according to hypothesis, the organism escapes from the gnat into the water in which she lays her eggs, it followed that water which contained most larvæ should contain most malaria parasites, and, conversely, that drinking water free from larvæ would probably be free from parasites. Now in attempting to apply these considerations to the case of the Sigur plantations, I found them at once opposed by many facts. Not only were there few adult mosquitoes there, but the larvæ could be found only in a few stagnant puddles in the depth of the jungle, while the drinking water was obtained from rapid streams just issued from pure mountain springs, in which larvæ neither existed nor were likely to exist.

These facts again forced me to reconsider the whole of Manson's secondary hypotheses, and to search for more plausible theories. Three such theories occurred to me. I had long observed that

while they are sucking blood, gnats deposit minute drops of excretæ on the skin every ten seconds or so; and I had actually shown that these drops may contain the pseudo-navicellæ of gregarines. It was therefore possible that they might contain the spores of the parasites of malaria, which might then be able to work their way through the skin and into the blood of the victim. Another hypothesis of mine was that the malarial spores might be voided by the insects, not upon the skin, but upon rotting vegetation or damp earth (*e.g.*, the floor of the houses and huts of natives), and might there possibly develop into some extracorporeal form capable of infecting man by air-borne spores.[1] The third theory was that infected mosquitoes could in some mysterious manner introduce the parasites directly into the blood during the acts of puncture and haustellation. This view was similar to that of King and Bignami, with this difference, that while these observers thought that the mosquitoes derived the parasites from marshes, I held, in consequence of Manson's induction, that they derived them from patients. In the account of my work in the Sigur Ghat which was published a few months later [40], it was stated that this was the hypothesis which I now held to be the probable one.[2]

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[1] This was by no means an idle conjecture, and was indeed strictly based upon the analogy of Cunningham's life history of the *Amœba coli*, which that observer stated was voided from the intestines of cattle and afterwards formed pseudo-plasmodia in the exposed dung—men and cattle being infected by the air-borne spores of these pseudo-plasmodia. He thought that the organisms were related to the Mycetozoa, and called them *Protomyxomyces coprinarius*. His important statements have been ignored but not disproved by subsequent writers. Similarly I thought that the parasites of malaria might possibly be extracted from the circulation by mosquitoes, be deposited by them upon the damp floors of dwelling houses, and there develop in a like manner. This hypothesis was at that time as cogent as any other.

[2] I said: "On the whole, from a consideration of the epidemiological facts, I should be inclined to favour the idea of contact being the mode of infection; and may add that one of my servants who was employed in catching the adult *silvestris* by allowing them to settle on his legs and arms, was attacked five days afterwards by the quartan parasite." By contact I meant contact of the mosquito with the skin, as explained further on by the following words: "Since the presence of a human being in the jungle at once causes a number of *silvestris* mosquitoes to attack him on all sides, it is very clear that he may readily be infected by their agency, either by injection of the parasite through the puncture, or by its deposition on the skin in the shape of spores contained in the insect's fæces, which, observation shows, are always discharged in quantity during the act of haustellation." My theories regarding infection are also referred to in my previous paper [30].

It was during these researches that I first noticed the "dappled-winged" mosquitoes. While looking for mosquitoes in a vacant rest house at the foot of the *ghat*, I captured an insect resting in a peculiar attitude with the body-axis at an angle to the wall (as I noticed at the moment). On examination, its wings were found to have a series of black marks along the anterior nervure; but as I saw no more individuals of the species, I did not think the observation to be of sufficient importance to be included in my paper. Yet, had I only known it at the time, this was the very species I was in search of!

Indeed, the whole of this investigation afforded a clear example of the well-known ambiguity of epidemiological work. Of the kind of insect which was really causing the disease at the time, I saw but a single individual! The reason is now quite apparent. Unlike the grey and brindled mosquitoes which rest in the dark corners of dwellings by day in large numbers, many species of dappled-winged mosquitoes fly out at daybreak. It is true that other species of this genus have more domestic habits and can therefore be more easily found; and if fortune had been my friend in those days she would have brought me to a place where these species abound—such as places afterwards visited by me in Assam and the Darjeeling Terai. Nor does it follow in any case that the predominant species of mosquito in a locality must be the malaria-bearing species there; there is no reason why the innocent species should not outnumber the dangerous species even in the most malarious spots; while, lastly, it is now known that the dangerous species may abound where there is no malaria at all. Hence, though I did not know it at the time, it is impossible to indicate, much less to certify, the malaria-bearing species by its numerical relations with other species in malarious localities.

One of the principal results of my work in the Sigur Ghat was that it led me to doubt the probability of infection by drinking water. I should have liked to remain there much longer; but on the expiration of my leave was forced to return to my regiment at Secunderabad, five hundred miles away, and was never able to visit the place again.[1]

(13) *Secunderabad:* 1897. *The Fundamental Discovery.*—On my return to Secunderabad (July, 1897), the first thing I noticed was that the malaria had continued unabated during almost two years

[1] I had been offered an appointment in Berar, but had declined it in order to carry on these researches in the Sigur Ghat. I suffered severely for this later on.

since I had left; if anything it was worse, and many recruits who had recently joined the regiment had been attacked—as they averred, for the first time. This clearly showed that these cases were not merely relapses, and that some cause of infection was actually at work among the troops. It was for me to discover the cause; and I determined to return to my old method, and to test experimentally all the kinds of mosquitoes prevalent anywhere near the barracks. I had now been studying the subject almost constantly for over two years, and had become so very familiar with the microscopical appearance of the various structures of the mosquito,[1] that I felt the mosquito stage of the parasite could no longer escape me if it existed at all. Numerous cases of crescents suitable for the experiments were in my hospital, and it was obvious from the number of fresh cases occurring that the proper kind of mosquito must be somewhere about. If I failed it could only be because there was some flaw in Manson's induction.

At the same time a possible fallacy was detected in the logic of that part of the theory which suggested that the motile filaments, after their escape from the parent cells in the mosquito's stomach, must take up their abode *in the tissues* of the insect. The vital and inevitable part of the induction consisted only of the reasoning which inferred that the stomach of the mosquito is the natural *locus* for the escape of the motile filaments. It was only conjecture to say that they must enter the tissues; because for all we knew it was possible that they might *remain in the intestine* for some time and then be voided, probably in some altered form, either upon the ground or upon the human skin (see my hypotheses in the previous section). It was therefore now necessary to examine the evacuations as well as the tissues of my subjects.

I commenced work by making a careful survey of the various kinds of mosquitoes which were to be found in the officers' quarters, in the regimental hospital, and in the numerous little houses of the native soldiers, which constituted the barracks, or "lines," as they were called. I found, first, the insects with which I was familiar during my previous studies here in 1895, namely, (*a*) several species of brindled mosquitoes, and (*b*) two species of grey mosquitoes. But at the same time I was astonished at observing that the whole place was overrun by swarms of (*c*) a small and delicate variety of mosquitoes, which were at once observed to rest with the body-axis

[1] This does not mean that I was equally familiar with the *macroscopical* anatomy of the mosquito—a subject which has only recently been dealt with fully.

at an angle to the wall, and which had spotted wings. In fact, they were evidently of the same genus (though not of the same species) as the mosquito which had been previously found in the Sigur Ghat —a genus, or perhaps family, quite distinct from those of the grey and brindled mosquitoes with which I had hitherto been working.

It is now time to speak more particularly of all these mosquitoes. I had written repeatedly to Manson, to various booksellers in England, and to several persons in India who I thought might help me, for some literature on the subject; but could obtain nothing except a few notes by popular authors, such as Thomas, who wrote on piscatorial subjects in India. I could not even obtain any adequate works on the anatomy of insects in general. Of Ficalbi's work on European gnats—which would have helped me immensely—I was ignorant, and received no copy. Manson had found the name of one species of mosquito which I sent to him; but this did not help me, for what I required was a scientific work on the structure and classification of the mosquitoes as a group. I was therefore obliged, as mentioned in Section 10, to trust to my own rough methods of classification; and these were based, not on the criteria of entomologists, such as the structures of the mouth parts or the nervures of the wings, but on the general appearance and markings, the eggs, the habits, &c., of the insects. It was only the working classification of an amateur without literature to guide him, and made for his own convenience; but as events have proved it was roughly correct. Up to July, 1897, I recognised the two following groups:—

(*a*) *Brindled Mosquitoes* (now recognised as belonging to the genus *Stegomyia*, Theobald). Body and legs boldly marked black and white, or brown and white. Wings plain. Biting voraciously, mostly in the daytime. Resting with abdomen hanging towards the surface of attachment, and the last pair of legs tilted on the back. Breeding mostly in pots of water. Larvæ floating head downwards and possessing short stumpy breathing tubes. Eggs black, oval, and laid separately.

(*b*) *Grey Mosquitoes* (now recognised as belonging to the genus *Culex*, Linn., as defined by Theobald). Back barred with transverse brown and white stripes. Legs and wings plain. Biting somewhat timidly, mostly at night. Resting with abdomen hanging towards surface of attachment. Breeding mostly in wooden tubs, ditches, garden cisterns, and drains. Larvæ floating head downwards and possessing long breathing tubes. Eggs elongated and somewhat lanceolate, and laid simultaneously in rafts.

I had found mosquitoes of the same genera, though possibly of different species, at Bangalore and at several spots in the Nilgherry Hills, and also at Bombay, Poona, and Madras, during short visits made to these cities in connection with my sanitary duties at Bangalore. I remembered also to have seen similar insects in Burma and the Andamans; so that it was reasonable to suppose that they constituted the common or ordinary kinds of mosquitoes in India. The new mosquitoes which I now and subsequently met with, and named dappled-winged mosquitoes, were evidently of quite another genus to the foregoing, and were distinguished by me by the following characteristics:—

(*c*) *Dappled-Winged or Spotted-Winged Mosquitoes* (now recognised as belonging to the genus *Anopheles*, Meig.). Body, legs, and proboscis marked brown and white, or dark and light brown. Wings with several dark blotches on or near the anterior nervure. Resting with abdomen pointed outward from the surface of attachment. Body more elegant, and shaped like that of a humming-bird moth. Breeding mostly in natural pools of water on the ground. Larvæ floating flat on the surface of the water like sticks and possessing no breathing tube at all. Eggs laid singly; cohering in triangular patterns, and shaped like an ancient boat with raised prow and stern, and surrounded with a membrane which—when the egg is seen in profile—gives the appearance of a bank of oars to the boat.

In the spotted-winged mosquitoes which I now found at Secunderabad, I noticed at once the general difference of shape, the peculiar attitude of the insects when at rest, the marks on the wings, and the appearance of the eggs (as seen within the body of the female when dissected); but the larvæ could not be studied until later.[1] The adults were very delicate, pale brown creatures, which by common consent seemed scarcely to bite man, though they were numerous enough to have caused much irritation had they done so. They swarmed in my own quarters, but seldom bit me. They abounded also in the houses of the other officers of the regiment, who, with their families, had remained quite free from malarial fever. Consequently I was not disposed to think that they had anything to do with the disease. On the other hand, the grey mosquitoes swarmed in the barracks, but were much less numerous in the officers' quarters (situated some hundreds of yards

[1] It was principally my assistant, Mahommed Bux, who ascertained, as a general rule, the attitude of the larvæ.

to leeward of the barracks). Suspicion therefore first attached to the latter variety.

I determined, however, not to be swayed by such considerations, but to make a most complete and exhaustive test of all the varieties which I could procure—even at the cost of repeating much of my old negative work, during which, laborious as it was, I may have overlooked the object I was in search of. A number of natives were employed to collect larvæ from far and wide round the barracks. These larvæ were kept in separate bottles, and when the adult insects appeared they were released within mosquito nets in which the patients were placed. The insects were applied sometimes during the day in a darkened room: and were sometimes fed all night. After feeding, the gorged insects were collected in small bottles containing a little water, and were kept for several days before being dissected. The procedure was therefore the same as before, but now, in order to ensure at least definite negative results, redoubled care was taken; almost every cell was examined, even the integument and legs were not neglected; the evacuations of the insects found in the bottles, and the contents of the intestine were scrupulously searched; at the end of the first examination staining reagents were often run through the preparation, and it was searched again with care. The work, which was continued from 8 a.m. to 3 or 4 p.m., with a short interval for breakfast, was most exhausting, and so blinding that I could scarcely see afterwards, and the difficulty was increased by the fact that my microscope was almost worn out, the screws being rusted with sweat from my hands and forehead, and my only remaining eye-piece being cracked, while swarms of flies persecuted me at their pleasure as I sat with both hands engaged at the instrument. As the year had almost been rainless (it was the first year of plague and famine) the heat was almost intolerable, and a punkah could not be used for fear of injuring the delicate dissections. Fortunately my invaluable oil-immersion object-glass remained good.

Towards the middle of August I had exhaustively searched numerous grey mosquitoes and a few brindled mosquitoes. The results were absolutely negative, the insects contained nothing whatever. Then, I think for the first time, I began to feel that the long quest had been in vain and that a flaw existed somewhere in the induction. The disease was there, the mosquitoes were there—how was it that I found nothing? I may perhaps be pardoned for dwelling on my personal feelings during that time, and the astonishing time which followed. Science, too, has its drama; and

the actor on that real scene cannot help being moved when he remembers it—although it may appear trivial enough to others.

I had remembered the small dappled-winged mosquitoes, but as I could not succeed either in finding their larvæ or in inducing the adult insects to bite patients, I could make no experiments with them. On August 15th, however, one of my assistants brought me a bottle of larvæ, many of which hatched out next day. Among them I found several dappled-winged mosquitoes, evidently of the same genus as those found about the barracks, but much larger and stronger. Delighted with this capture I fed them (and they proved to be very voracious) on a case with crescents in the blood. Expecting to find more in the breeding bottle and wishing to watch the escape of the motile filaments in this new variety, I dissected four of them for this purpose immediately after feeding. This proved to be most unfortunate, as there were no more of these insects in the bottle, and the results as regards the motile filaments were negative. I had, however, four of the gorged dappled-winged mosquitoes left, but by bad luck two of the dissections were very imperfect and I found nothing. On August 20th, I had two remaining insects both living. Both had been fed on the 16th instant. I had much work to do with other mosquitoes, and was not able to attend to these until late in the afternoon, when my sight had become very fatigued. The seventh dappled-winged mosquito was then successfully dissected. Every cell was searched, and to my intense disappointment nothing whatever was found, until I came to the insect's stomach. Here, however, just as I was about to abandon the examination, I saw a very delicate circular cell apparently lying amongst the ordinary cells of the organ, and scarcely distinguishable from them. Almost instinctively I felt that here was something new. On looking further, another and another similar object presented itself. I now focussed the lens carefully on one of these, and found that it contained a few minute granules of some black substance exactly like the pigment of the parasite of malaria. I counted altogether twelve of these cells in the insect, but was so tired with work and had been so often disappointed before that I did not at the moment recognise the value of the observation. After mounting the preparation I went home and slept for nearly an hour. On waking, my first thought was that the problem was solved, and so it was.

Next morning I returned to the hospital with much apprehension lest the eighth and last dappled-winged mosquito should have died and become decomposed during the night. It was alive, and

was killed and dissected with much anxiety. *Similar bodies were present in it, only they were distinctly larger.* The seventh mosquito had been dissected four days after finding; the eighth five days after feeding; the parasites in the latter had lived a day longer than those in the former and were consequently larger. Both insects had been bred from larvæ in captivity; both had been fed for the first time on the same person—a case of malaria; no such objects as these pigmented cells—as I then called them—had ever before been seen in the hundreds of mosquitoes examined by me; the objects lay, not in the stomach cavity of the insect, but in the thickness of the stomach wall; all contained a number of black granules precisely similar in appearance to those contained by the parasites of malaria, and quite unlike anything which I had ever seen in any mosquito previously. Lastly, these two mosquitoes were the first of the kind which I had ever tested.[1]

The mind long engaged with a single problem often acquires a kind of prophetic insight, apparently stronger than reason, which tells the truth, though the actual arguments may look feeble enough when put upon paper. Such an insight is mainly based, I suppose, on a concentration of small probabilities, each of which may have little weight of itself; but in this case at all events the insight was there and spoke the truth.

These two observations solved the malaria problem. They did not complete the story, certainly; but they furnished the clue. At a stroke they gave both of the two unknown quantities—the kind of mosquito implicated and the position and appearance of the parasites within it. The great difficulty was really overcome; and all the multitude of important results which have since been obtained were obtained solely by the easy task of following this clue—a work for children. We may rest assured that if these observations had not been made we should still have remained ignorant of the mode in which this important disease, with its annual death roll of millions, is propagated—aye, and would have remained ignorant of it until some one else had taken up the same investigation by the same method.

And no other method would have solved the problem. It was

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[1] On the assumption that these cells had developed from the motile filaments, it was difficult at the moment to explain the pigment within them—as the motile filaments have no pigment. I thought it possible, however, that after fixing themselves in the stomach wall they might be able to derive hæmoglobin from the contents of the organ, and afterwards convert this into the pigment.

necessary to find not one but two unknown quantities, and neither could be found by itself. There are no phenomena which would serve to indicate the kind of mosquito. In nearly all malarious places there are many kinds of mosquitoes, and, as in the Sigur Ghat and other places, the malaria-bearing species are in no way predominant among them either in numbers or in any other way. Indeed, the malaria-bearing species occur in places where malaria has not been known in the memory of man, as around Liverpool. By what process of reasoning then could we isolate the species? It might possibly have been practicable to detect it by a very long series of experiments aimed at infecting men by the bites of successive species of mosquitoes; but no one would have undertaken such a work without the guide of a very strong theory in favour of inoculation by the bite; and the theory of King and Bignami to this effect was little more than a conjecture. It was not likely that the first species tried would have given successful results, as my own experiments of 1896 showed. Even if, after a multitude of costly and dangerous experiments, a positive result had been attained by this method, it would always be open to doubt (seeing that the experiments would have to be done in a malarious country) whether the case was not merely one of relapse; and another long series of experiments would be required to eliminate this doubt. And then, even when the proper species of mosquito was detected, there would still be no guide to the form and position of the parasites within it, or even to the way in which they enter the insect (Bignami thought that they enter the larvæ from marsh water). No, the thing was not practical. Bignami himself abandoned his experiments on his own theory after the first failure [29], and did not resume them until after my work had clearly indicated both the kind of mosquito implicated and the route of infection. The only practicable method was to attempt to find both unknown quantities simultaneously by the trial and failure system—such as I adopted.[1]

The discovery of the pigmented cells, therefore, ended for me, at least, the old research, the period of doubt, the groping in the dark. The secret spring had been touched, the door flew open, the path led onward full in the light, and it was obvious that science and humanity had found a new dominion. But it was necessary to follow the clue forthwith; to watch the development of the pig-

[1] I mention these facts because many writers on the subject seem to think that the original discovery was made merely by catching the first mosquito and finding the pigmented cells within it.

mented cells in mosquito after mosquito, to ascertain what became of them, to fathom the mystery of the route of infection, and then—to save human life in the gross, perhaps to open continents to civilisation.

The first thing was to obtain more—hundreds—of these large dappled-winged mosquitoes. Alas, the man who had found them had, contrary to my orders, put the larvæ from many sources in the same bottle! All the larvæ from all these sources were collected, but no more dappled-winged mosquitoes! I turned then to the small but similar variety which swarmed about the barracks. Being evidently of the same genus, they too would probably harbour the parasites; but though my men and myself searched high and low for their larvæ, we could not find them. I could scarcely even persuade the adults to lay their eggs in captivity.

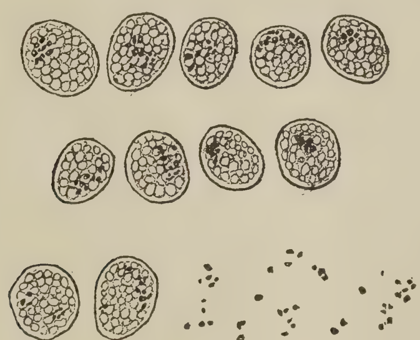

FIG. 2.—Pigmented cells (zygotes) of æstivo-autumnal parasite in dappled-winged mosquitoes (*Anopheles*). From Ross's paper, *British Medical Journal*, December 18th, 1897, p. 1,787.

Thinking that in spite of all my care I may have overlooked the pigmented cells in the grey and brindled mosquitoes, I now searched for them in the stomachs of a number of these, but without result. A number of the small dappled-winged mosquitoes caught about the hospital were also examined for them in vain. These observations served, however, for a "control" on the two positive cases.

Owing to the great heat at Secunderabad I had been obliged to leave my family at Ootacamund, and was now compelled to go to Bangalore for a few days in order to settle them there for the remainder of the summer. This gave me leisure for writing a report to the Government of India on the discovery of the pigmented cells, and also a short paper on the same subject for publication.

The latter was of course intended only as a preliminary to a detailed report, which I hoped to be able to publish in a few months, and which I thought would contain the full explication of the whole problem. I described my method in a few opening lines, being careful to note that the mosquitoes used by me had been "bred in bottles from the larvæ." The mosquitoes were then described as well as possible—the spots on the wings and the peculiar shape of the eggs being noted, but reference to the peculiar attitude being inadvertently omitted. Next I gave in detail the circumstances under which the pigmented cells were found, together with a description of them; and finally discussed, very guardedly, their probable relation to the parasite of malaria. I had brought the original preparations with me, and now showed them to my friend, Surgeon-Major John Smyth, who at my request kindly added a note to my paper corroborating my description. They were then despatched by post to Manson. My paper, however, did not appear until December [38]; but when it did so it was accompanied by an excellent drawing of the pigmented cells furnished at the instance of Manson, and also by remarks of Manson, Bland Sutton, and Thin, who discussed the new objects—the last holding that the cells were ordinary cells of the stomach wall into which malarial pigment had entered in some manner from the stomach cavity. This preliminary article was published by me for the express purpose of guiding the researches of others; and in fact, anyone who had read my description of the pigmented cells and of the dappled-winged mosquitoes, would now have had little difficulty in repeating my work.[1]

On my return to Secunderabad I was much disappointed to find that the larvæ of neither the large nor the small species of dappled-winged mosquito had yet been collected. Consequently, in the intervals of searching for them, I spent my time in examining the stomachs of all the mosquitoes I could catch for the pigmented cells. I hoped especially to find them in the small dappled-winged insects caught about the hospital, where there were several cases of malaria, but was disappointed. On September 18th, however, a large grey mosquito was observed feeding on a patient suffering from the benign tertian parasites, and was promptly secured. The stomach was full of black blood, so that it must have fed previously (freshly imbibed blood showing red in the insects) as well as on this occasion.

[1] This is exactly what was done by the Italian observers fifteen months later (see section 23).

It was kept until the 21st and was then dissected. To my delight the pigmented cells were again found, in considerable numbers; but they were larger even than those of the mosquito of August 21st. As this particular insect had not been bred from the larva in captivity I could not say for certain where it had become infected, but I thought it likely that it had been feeding on the case of tertian all the time (that is from about a week before it was killed) as the patient was in a bed by himself in a corner of a large nearly empty ward. Hence I naturally inferred as a probability that the pigmented cells in this insect were derived from that case; and I thought that their large size suggested that they must have been so derived about a week before the insect was killed. But of course I could not speak with absolute assurance on these points.[1]

Meanwhile swarms of small grey larvæ had been found in an isolated pool of rain-water, which I had overlooked because it was on the top of a hillock where pools were not likely to exist. On hatching out, these were found to be the long-sought larvæ of the small dappled-winged mosquitoes. I observed at once that they had no breathing tubes and that their attitude was peculiar as compared with the larvæ of other mosquitoes; and noticed also that the pool in which they were found seemed too shallow and evanescent for the latter—facts shown by me and my colleagues in 1899 to be of the greatest importance in connection with the prevention of malaria. Directly enough of the adults appeared from the larvæ in the breeding-bottle, they were released in large numbers within the mosquito-net of a patient with crescents in his blood. Next morning only two of them were found to have fed themselves. One was killed next day, but nothing was found in it. The second was killed the day after, and was found to contain a large number of very small pigmented cells! This really almost clinched the matter; for three out of four dappled-winged mosquitoes bred from the larvæ in captivity and fed on cases of crescents, had been found to contain pigmented cells; while these cells could not be seen in insects of the same kind which had not been so fed. Just at this time I wrote to Manson, in a state of unbounded delight, that he might expect to know the full life-history of the parasites of malaria in the mosquito within a few weeks.

Next day, however, I received telegraphic instruction from Government, ordering me to proceed forthwith to Kherwara in Rajputana—a place 1,000 miles distant!

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[1] This mosquito also contained a number of the swarm-spores which I had observed in the Sigur Ghat.

(14) *Interruption : September*, 1897—*February*, 1898.—It would be difficult for others to understand the effect of this cruel blow. Here in Secunderabad, I had numerous cases of malaria in my own hospital, and, moreover, the men had been trained to submit to mosquito bites—a matter often of some difficulty with the superstitious natives of India. I had also experienced assistants hired by myself for the work; and, above all, the proper kind of mosquitoes, including their larvæ, just found in abundance. There is no doubt whatever that, had I been left at Secunderabad, I could easily have traced the whole life history of the human parasites in dappled-winged mosquitoes within a few weeks. But at Kherwara I did not know what would happen. It was in the north; winter was approaching; and I knew that mosquitoes would refuse to bite in the cold. I failed even to guess the reason for this sudden transfer. The astonishing discovery of the pigmented cells had been officially and fully reported to the Government through the chiefs of my own department; malaria is the most important disease of India; and I thought that my superiors were taking the greatest possible interest in researches which touched so vital a subject—I thought that they would make every effort to leave me undisturbed, if not to give me active help.

But the orders were peremptory and not to be discussed. Within two days (September 26th) I was on the week's journey to Kherwara. I saw only one gleam of comfort. It was impossible that my chiefs, medical men, would consent to interrupt my work at such a moment. There must undoubtedly be a bad outbreak of malarial fever at Kherwara, which would throw great light on my subject.

When I arrived at the place, however—a petty station with three or four Europeans (whom I shall always remember for their kindness), and part of a native regiment of Bhils, isolated in the midst of miles of wild country far removed from civilisation—I was told that there was no malaria there; there had not been a case for months.

This, then, was my Elba—almost my Île. du Diable, and I saw no prospect of escaping from it for a year at least. After excusing myself from accepting the appointment in Berar, I had, indeed, later asked to be remembered for a permanent appointment to which I thought my long service (more than sixteen years) and my work at Bangalore had at least given me some claim. But this was only a temporary and insignificant one, generally held by juniors; and I do not know why the transfer was made, unless possibly (though not certainly)

for reasons connected with the Afridi war. At all events it was made without reference to my researches. I wrote officially to my superiors, begging to be allowed to return to Secunderabad to continue my work, but received only a reprimand in consequence. There was no escape, but my pension was due to me the following April, and I made up my mind to apply for it as soon as the war was over, and to continue my researches as a private person.

The cold weather came on apace, and at first it appeared to be utterly impossible to work. There were no cases of malaria and scarcely any mosquitoes. Much to my pleasure, however, I found a few dappled-winged gnats, and observed again that their larvæ lived in water *on the ground*—namely, in a pit and an old well, apparently almost as dormant as the adults were. I kept a single one alive in a bottle for two months without its developing.

Shortly after arrival at Kherwara I wrote down a brief account of the finding of the pigmented cells in the third and fourth mosquitoes. At the end of January the *British Medical Journal*, containing my previous paper on the cells [38], together with remarks by Manson, Bland Sutton and Thin, reached me. I therefore re-wrote the beginning of my second paper, and added a reference to some work which I had been able to do with pigeons, and also a long discussion of Thin's remarks, in which I showed that his position with regard to the pigmented cells was untenable. The paper was published in February. I did not explicitly say that the third dappled-winged mosquito had been bred from the larva in captivity, because it was evident that this fact would be inferred from the opening of the first paper of which the second was obviously a continuation. But I said that the grey mosquito, in which pigmented cells had been found, was "*observed* feeding on a patient," and that "I judged for many reasons that it had been feeding occasionally on the same man for several days," showing clearly enough that this insect had not been bred from the larva in captivity. The facts might have been put more explicitly at the time; but they are apparent enough to any candid reader.[1] In the paper the order of the third and fourth mosquitoes is changed for purposes of description, the case of the grey mosquito being put last because it was doubtful.

[1] When I wrote these papers I did not suspect that every line of mine, even in some of my private letters, would be subjected to a minute and unscrupulous analysis in the hope of finding discrepancies which would serve to discredit my observations. Every possible artifice has been used for this purpose by the very men who learnt all they knew from these very publications.

The work with pigeons just referred to was as follows: Being unable to obtain cases of human malaria I turned to the malaria of birds, which had long been known to harbour parasites closely similar in appearance and life-history to the malaria parasites of man. Both Manson and I had long recognised the technical advantages of working with these organisms. I immediately found the parasites of Labbé's genus *Halteridium* in the pigeons of Kherwara, but could not induce mosquitoes to bite the birds. Observing, however, that they were infested by a species of blood-sucking fly, I examined thirty of these, and some lice, fed on infected pigeons. No pigmented cells were, however, found in them.

At last, when the weather became warmer in February, several cases of quartan fever occurred among the troops, probably relapses. The dappled-winged mosquitoes still refused to bite; but I succeeded in feeding a number of brindled mosquitoes of a peculiar brown species on the cases. The results were again negative in thirty-four of these insects.

I was just about to apply for my pension when welcome news arrived. I had, of course, given full details of my sudden transfer to Manson, and he had exerted himself to influence the Government of India and the Director-General of the Indian Medical Service (then Surgeon-General Cleghorn) to put me on special duty to continue my researches. I had urged the same thing upon the Director-General; but, unfortunately as it happened, suggested that one good place for the work would be Assam, where an epidemic of *kala-azar*—a disease which Rogers had recently reported to be malaria—had long been raging. However, I now received a telegram stating that I had been placed on special duty to investigate malaria and kala-azar in Calcutta and Assam for six months.[1] My five months' imprisonment was at an end. I arrived in Calcutta on February 17th, 1898, and was joined there by my family, with all my books and notes, which had been with them at Bangalore all this time.

(15) *Calcutta: February—April,* 1898. *The Theory Proved.*—Now, in recompense for the tribulations of Kherwara, opened a glorious time, during which the amazing story of malaria was unrolled little by little. The great induction had given the clue; now, following the clue step by step, we were to be led into regions where Nature revealed herself wonderfully beyond the imagination of any of us. In the background was something greater still—the possibility of saving human life on the large scale.

[1] Afterwards extended to one year.

I am happy to be able to begin this part of the narrative with a brief account of the brilliant and important discovery of MacCallum. It will be remembered that Manson had thought the motile filaments to be flagellated spores; that I had studied them much without being able to learn anything new about them except that they are certainly living organisms; and that when I finally found the pigmented cells I thought that these were derived from the motile filaments, and had absorbed their melanin from the hæmoglobin in the stomach cavity of the insects. In his letter of August 11th, however, Manson sent me a paper by Simond, suggesting that the similar motile filaments of certain *Coccidia* are not of the nature of flagellated spores at all, but of the nature of sperms [35]. How were these facts to be reconciled?

In a letter dated November 17th, 1897, Manson informed me that a discovery had been made by W. G. MacCallum, in America, regarding the motile filaments, showing independently that they are of the nature suggested by Simond's work. He did not send me the literature, and as his letter reached me at Kherwara I could not then obtain it. Shortly after my arrival at Calcutta, however, I procured a copy of the *Lancet* [36], which gave an abstract of MacCallum's work. The discovery was as follows:—

In 1897 MacCallum undertook a study of the motile filaments. Working with the *Halteridium* of birds he noticed first that the gametocytes seemed to be of two kinds, namely, one kind which produced the motile filaments, and another kind which did not do so. On watching two of these cells, one of each kind in the same field of the microscope, he observed (July 1897) that the filaments escaped from one as usual; that it moved about actively for a time; and then, approaching the other gametocyte, actually entered it. Other observations of MacCallum and Opie, made both on *Halteridium* and on the crescentic gametocytes of the æstivo-autumnal parasite of man, confirmed this beautiful discovery. The fact, as previously shown by Sacharoff, that the filaments contain chromatin, was now explained; and also the facts that they escape and move about in the blood. They are, indeed, sperms which are emitted from the one kind of gametocytes, the males, and which fertilise the other kind, the females. Thus these minute parasites, among the lowest of creatures, have their sexes, and a form of sexual reproduction precisely like that of the highest animals.

More than this, MacCallum observed in the case of *Halteridium* of the crow that the female cell, motionless before fertilisation, afterwards becomes elongated and vigorous, and moves across the

field *in vitro*. This motile form had apparently long been seen by Danilewski and had been called by him a *vermicule*.[1]

So much for the motile filaments: but now what were the pigmented cells? Everyone seems to have thought that as soon as the flagellate spores disappeared, so did Manson's theory. But it was not so. The induction remained as strong as before; the locus of the phenomenon was still in all probability the stomach-cavity of the mosquito. MacCallum's work seems to have reached Manson shortly after my discovery of the pigmented cells came to him. He connected the two groups of facts in a moment. *My pigmented cells were the vermicules, or fertilised female cells, which had burrowed into the insect's tissues for the purpose of undergoing further development there.* This, and not my hypothesis made before MacCallum's paper was known to me, explained the presence of pigment in the cells. He communicated his views to me in his letter of February 7th, and published them later [41].

Meanwhile, after another struggle, I was again in sight of the pigmented cells. On my arrival at Calcutta I found myself installed in the convenient little laboratory which had been formerly used by Professor D. D. Cunningham. There was a native assistant there, but I hired at my own expense several others, especially a most intelligent Mahommedan named Mahommed Bux, who after he had been trained showed great enthusiasm and gave me much assistance. To my delight I at once noted several varieties of dappled-winged mosquitoes, besides many kinds of grey and brindled mosquitoes, actually within the laboratory, and found the breeding-places of the latter just outside. Those of the dappled-winged mosquitoes were detected a little later, and were again seen to be pools of water on the ground. The next thing was to obtain cases of malaria, but here I was met by an unexpected and most unforeseen misfortune. The plague had been raging all this time in India, and on the Government's trying to introduce Haffkine's prophylactic inoculation in Calcutta just before my arrival, serious riots, during which many of the Europeans had felt themselves obliged to go about armed with revolvers, had occurred. The ignorant populace, thinking that the British were trying to inoculate them

[1] I should certainly have observed these facts when I was making a special study of the motile filaments in 1895 and 1896. I repeatedly saw them apparently attacking leucocytes [42, page 14]. The reason why I found that only a percentage of crescents emit the filaments in the mosquito's stomach is now explained—the remainder were females (section 11).

with, and not against, plague, flew into paroxysms of terror at the very sight of a European *hakim* (physician), while anything remotely resembling inoculation made them frantic. The physicians of the Calcutta hospitals were evidently very unwilling that I should use their cases for my experiments under these circumstances, and as I had no hospital of my own, as in Secunderabad and Bangalore, I was forced to send my assistants into the bazaar (native parts of the city) in order to try to induce patients to come to me on payment. Calcutta is not very malarious, especially at that time of the year, and it was only on large payment that several beggars with fever were induced to come to me; but when I proposed to prick their fingers in order to examine their blood, they generally left their money, took up their crutches, and fled without a word. This placed me in complete perplexity as to what to do, until I remembered the malaria of birds. A number of crows, pigeons, weaver-birds, sparrows and larks were then immediately procured, and experiments commenced on them without delay.

The malarious parasites of birds are exceedingly closely related to those of men, and together with these and the malaria parasites of bats and monkeys, form a group which is quite distinct from the intracorpuscular protozoa of some mammalia, such as the *Pyrosoma bigeminum* of cattle, and of reptiles, such as *Drepanidium*. The true malaria parasites (namely, the intracorpuscular protozoa of man, birds, bats, and monkeys) are distinguished by their generally amœboid character, by their possession of the characteristic black or brown pigment (melanin), and by an identical life-history as regards the production and appearance of the spores within the corpuscles, and of the motile filaments, shortly after the blood containing them is drawn from the host. The parasites of birds differ from those of man only in some very small morphological details; and are so similar that in the earliest sub-classification of the group by Grassi, one of the parasites of birds, commonly called *Proteosoma*, is placed with two of the human species, the quartan and tertian, in one genus; while the other parasite of birds, commonly called *Halteridium*, is placed in another genus, together with the remaining parasite of man, that of the pernicious, remittent, or æstivo-autumnal fevers. The latter part of Grassi's classification was wrong; and we now recognise that both the parasites of birds must be placed in one group with the quartan and tertian parasites of man; while the third human species must be placed in a group by itself, owing to the distinct shape of its gametocytes (crescents). Thus, zoologically, the avian species are actually more nearly related

to two of the human species than these are to the third human species. Anyone who had actually studied all these parasites, moreover, would have little doubt that they would be found to possess practically identical life-histories outside the vertebrate hosts, or at least life-histories which, if not identical, would be closely similar. It did not of course follow with certainty that the carrying agents of the avian parasites would be the same as those of the human species ; but we could safely assume that they would be some kind of blood-sucking arthropod. At all events it was certain that the discovery of the life-history of the avian parasites would immediately open up that of the human organisms ; while the practical difficulties of working with birds and infecting them would be less than with men. In fact, I should have been wise to have begun my researches with birds in 1895. I therefore determined to employ birds at once, pending the subsidence of the plague-scare, when I purposed, of course, to return to the human parasites ; and there is no doubt that this was the right course.

It was first advisable to see whether mosquitoes would not carry one or both of the avian parasites. A number of crows and pigeons had been found to contain *Halteridium;* but without waiting to examine the other birds, I placed one crow, two pigeons, four larks and six sparrows, in several cages all within the same mosquito netting, and then in the evening released within the net a number of grey and brindled mosquitoes bred from the larvæ in captivity. Next morning many of the grey mosquitoes were found gorged, and were collected and kept for several days according to my rules. On March 13th and 14th, I dissected them one by one. When thirteen had been examined with negative results I began to fear that I had committed myself to another tedious search for the proper kind of host of the avian parasites. But fortune was kinder on this occasion ; the fourteenth mosquito had pigmented cells precisely similar to those which I had found in the dappled-winged mosquitoes fed on patients with crescents.

Next I examined the larks and sparrows used in this experiment, together with the crows and pigeons, and found that they contained not *Halteridium* but *Proteosoma*, so that it was doubtful from which kind of parasite the pigmented cell had been developed. Consequently I now put the birds with *Halteridium* in one net and those with *Proteosoma* in another, and released within both nets numbers of grey mosquitoes bred in the same bottle. Of thirty-four of these fed on the birds with *Halteridium* all were negative ; but out of nine fed on the birds with *Proteosoma*, no less than five contained pigmented cells.

This result was obtained on March 20th, and practically proved the mosquito theory of malaria. Out of hundreds of grey mosquitoes previously examined none had contained pigmented cells except one, which had been caught feeding on a case of tertian (section 13), and one which may have bitten one of the birds with *Proteosoma* in the experiment of March 14th. Now, however, no less than five out of nine fed on birds with *Proteosoma* contained them. Mathematically, therefore, the probabilities were enormous (amounting almost to certainty) in favour of the view that the pigmented cells in this experiment had been derived from the *Proteosoma*. The cells were in the tissues of the insect; the parasite must therefore be able to make its way into and live in mosquitoes ; precisely similar cells had been found in mosquitoes fed on men with malaria —and the chain of proof was complete.

But the fact that the pigmented cells in the mosquitoes are indeed derived from the parasites in the birds was of such fundamental importance that it required the most formal and rigid proof —especially as no life-history of a protozoal organism able to transfer itself from one host to another was then known to science.[1]

I therefore now commenced a long series of differential experiments in order to establish the fact thoroughly. Grey mosquitoes bred from the larvæ in captivity were fed (*a*) on birds with *Proteosoma*, and (*b*) on birds without *Proteosoma*, and the results compared. The details will be found in my Report [42]. Out of 245 grey mosquitoes fed on birds with *Proteosoma*, 178, or 72 per cent., contained pigmented cells, while out of 249 of them fed on blood containing other parasites or no parasites, not a single one contained them.

Another experiment was the following. Three sparrows were selected, one with no parasites, one with a few *Proteosoma*, and one with many *Proteosoma*. They were placed in separate nets, and numbers of grey mosquitoes from the same breeding bottle were fed simultaneously but separately on them. Ten mosquitoes fed on each bird were then examined, and the total number of pigmented cells in all of them were counted. The results, from a hasty enumeration made by myself, were as follows. No pigmented cells were found in the ten mosquitoes fed on the sparrow without parasites ; 292 in the ten mosquitoes fed on the sparrow with a few *Proteosoma;* and 1,009 in the ten fed on the one with many

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[1] The life-history of *Pyrosoma* in ticks is not even yet known; and the transference of trypanosomes by flies appears to be merely mechanical.

Proteosoma [42]. The preparations were sent to Manson, who made a more careful enumeration, and found 0, 571, and 1,084, pigmented cells in the three sets of mosquitoes separately [41].

The fact then was proved, and the theory that the parasites of malaria develop in mosquitoes was practically established. Meanwhile I had been proceeding in the fascinating task of watching the progress of that development. A number of grey mosquitoes would be fed on an infected bird and would be dissected two, three, four days, and so on, afterward. It was thus found that the pigmented cells grew rapidly in size until about the eighth day, when they became so large as to be almost visible to the naked eye. At this point they seemed to become mature, and it could be seen that many of them burst within the insect; because mosquitoes which had been infected more than eight or nine days before dissection were found to contain, not the mature pigmented cells, but only their empty capsules. For the moment I could not ascertain what became of their contents.

This part of the work led to an interesting observation which influenced all subsequent researches on mosquito-borne disease. It will be remembered that Manson had always thought that a few days after her meal of blood the female mosquito laid her eggs and died; at this moment he considered both filariæ and malaria parasites escape into the water from the insect [26]. I had accepted this view, but had frequently observed that the insects do not die immediately after laying their eggs; and now, as I watched the pigmented cells growing larger and larger without apparently ripening, even five days after the insect was fed, it occurred to me that we had been allowing our mosquitoes to die so early owing to a very simple reason—we had omitted to feed them again! I therefore fed my infected mosquitoes a second and a third time, and more; and found that I could easily keep them alive for a month.[1] This enabled me to work out the development of the malaria parasites completely; and also helped others subsequently to find a further stage in the development of filariæ, and to ascertain the mode of infection in yellow fever.

I did not succeed, and, indeed, scarcely attempted to find the host of *Halteridium*. Nor was there time to work out the formation and behaviour of the "vermicules" in the stomach cavity of the mosquito—although this could have been done very easily; but on

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[1] I re-fed them on healthy birds, but Bancroft subsequently found that they could be kept alive for some time on bananas.

one occasion I saw the motile vermicule of crow's *Halteridium* in a brindled mosquito.

Of course all this time anxious efforts had been made to obtain cases of human malaria for experiment. Early in March I succeeded, after much difficulty, in finding an old beggar with a few crescents willing to submit to the dreaded operations; and I examined forty-one grey mosquitoes and fifteen dark greenish dappled-winged mosquitoes which had been fed on him. The first kind were tried merely as controls, and were of course negative; but, much to my surprise and disappointment, so were the latter. I attributed the failure to the facts that the crescents were very scarce in the patient, that the mosquitoes fed very sparingly, and that there was a spell of very cold weather (for Calcutta) at the time. A few unsatisfactory experiments with grey mosquitoes fed on a child with mild tertian parasites also failed. In spite of all efforts no other cases could be procured.

A full list of all these experiments, beginning with my earliest work in 1895, will be found in my Report written a few weeks later [42].

Recognising, of course, the inadequacy of my nomenclature for mosquitoes and the urgent necessity for employing the correct entomological names for the various species used by me, and having failed to obtain any literature on the subject, I now applied for assistance at the Indian Museum in Calcutta; but I received a brief reply to the effect that the *savants* there could give me no information on the subject. Once more I had to depend on myself, and I therefore took special note of the dappled-winged mosquitoes found near my laboratory. No less than four species were detected —a large brown species, a large greenish one (with which the experiments just described were made), a small black one, and a small brown one. The first was named later by Giles from specimens brought to England by me, and was called by him *Anopheles rossi;* and from the studies of Stephens and Christophers made in Calcutta some years subsequently it is almost certain that the second species was *A. fuliginosus*.

Numerous specimens of *Proteosoma* in grey mosquitoes were sent to Manson on March 30th.

By the middle of April I had overworked myself, and was obliged to ask for ten days' leave to the Himalayan hill-station, Darjeeling, where I hoped for time to write my report in a cool climate. I had heard also of several intensely malarious spots at the foot of the Darjeeling mountains, and hoped to be able to carry

on there the studies on human malaria which were debarred in Calcutta, and at the same time to continue my work on avian malaria. I therefore left Calcutta on April 17th.

(16) *The Darjeeling Terai: April—June,* 1898. *Efforts to Obtain Assistance.*—The results with *Proteosoma* were obviously so important that it was necessary to give them to the world at once, in the hope that many observers would now be easily able to follow the work, and also that I might obtain assistance in consequence of my success. Consequently I devoted my time at Darjeeling to writing a report to my chief, the Director-General of the Indian Medical Service, on my latest work. The report begins with a brief statement of my first discovery of the pigmented cells,[1] followed by a list of the experiments, both positive and negative, which I had made with a view to infecting mosquitoes with human malaria. Then comes a detailed account of experiments and positive results with *Proteosoma,* followed by a minute description of the necessary *technique,* and of the appearance, position, and development of the pigmented cells. Next I discussed several points, including the bearing of MacCallum's work on mine. As I had brought my microscope and some of my specimens with me, I was able to add to the report large plates giving drawings of the pigmented cells up to the stage to which they had as yet been traced.[2] The work was, however, hurriedly executed, as I had only a few days in which to write it. The pigmented cells are called in it "proteosoma-coccidia," a term which has been criticised. I thought at that time that the parasites of malaria really belonged to the Coccidiidæ, the early stages of their life being passed in man and birds, and the later stages (to which the name Coccidia might more appropriately be attached) in the mosquito, just as the early and later stages of the sexual forms of *C. oviforme* occur respectively in the bile ducts and the intestine of the rabbit. At the end of the report a description of the grey and brindled mosquitoes, with drawings, is furnished by Mr. G. C. Dudgeon, a gentleman who was acquainted with entomology; and the report concludes with the words, "These observations prove the mosquito theory of malaria as expounded by Dr. Patrick Manson. . ."

The report, after some delay, was dated May 21th, and was despatched at once, with an urgent request that it might be published as soon as possible. To my surprise I was informed that

[1] In the twelfth line the word "ordinary" is a slip of the pen for "other."

[2] These plates are reproduced at the end of this publication.

publication was not allowed without the permission of the Secretary of State for India. This meant writing to England and several months' delay; but the report was printed very soon, and numerous

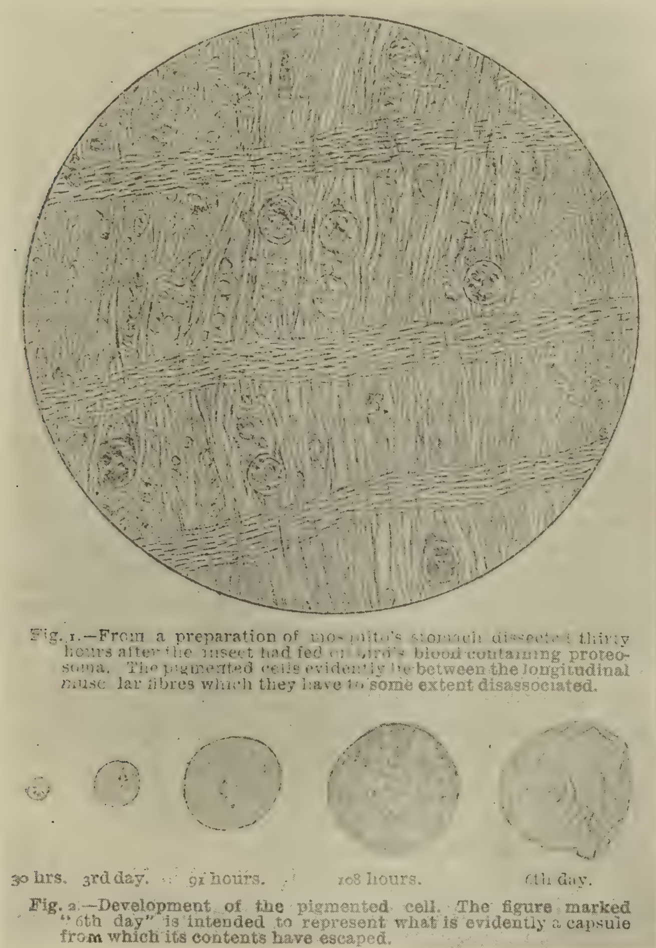

FIG. 3.—From paper by Manson, *British Medical Journal*, June 18th, 1898, p. 1,577. After Ross's drawings.

copies were sent at the end of June to Manson for private circulation among persons interested in malaria. In the meantime my success had been described in detail both to Laveran and Manson in letters dated April 22nd—the letters being accompanied

by a series of seventeen more preparations; and, as my results could not be published by myself, I now asked Manson to publish them for me.

On June 18th Manson published an able paper on the subject. The article commences with a *résumé* of my original discovery of pigmented cells in dappled-winged mosquitoes fed on a human patient with malaria, and gives the references to my papers describing the observation [41]. It goes on to describe the new results with *Proteosoma*, giving drawings of the pigmented cells up to the sixth day of development, and a diagram showing the connection between MacCallum's observation and my own; and it concludes with letters from Nuttall and Laveran accepting my results. Laveran said, "It appears to me to be undoubted that the elements discovered by Dr. R. Ross in the stomach of mosquitoes fed on the blood of birds, the subjects of hæmosporidiosis, are really parasites, and that these parasites represent one of the phases of the evolution of the hæmatozoa. . . . I have shown the preparations to M. Metchnikoff, who shares my opinion." [1]

This paper drew general attention to my work, to which previously little credence had been attached; and, as many of my preparations had been sent to England and France, not only were those competent to form an opinion enabled to judge of the truth of my statements, but those who wished to follow my steps were now easily able to do so. In fact, a most amusing comedy now commenced, in which we witnessed the hasty efforts of those who had been sceptics, not only to follow my steps, but to persuade the world that their labours were original. During several years since that date every observation of mine has been independently discovered by various writers.

Recognising the vast significance of these preliminary results with *Proteosoma*, and also feeling that it was quite beyond the power of one man to complete, as quickly as the interests of humanity demanded, the work which remained to be done, I now made strong efforts to obtain assistance. The help of a single medical man to collect mosquitoes and cases of malaria for me would certainly have enabled me to reach the last proofs in a month or two; and be it remembered, the mortality from fever in India alone is said to amount to something like ten thousand persons every day. When, however, I asked the Director-General for the services of one or

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[1] Owing to a misapprehension, this paper erroneously states that *Halteridium* also had been cultivated.

more junior medical officers, I was told that none could be spared at the time. As a matter of fact there are always many medical officers in military employment in India, who can be spared if they are urgently called for; and the truth is that the necessary trouble was not taken. I then wrote to Manson, begging him by all means in his power to obtain assistance for me from England; and thought that the Royal Society, which is subsidised to a small amount by Government, might afford to give it. The matter was considered; and it was finally agreed to appoint, with the help of the Colonial Office, a commission of three gentlemen to investigate malaria. Two of these were sent in the autumn to study the subject in—Italy; and after much difficulty, the third was allowed to come to me. He arrived at Christmas with orders to stay for two months—not to help me, but to verify my statements!

That was all the help I received. The excuse is that my work had not been confirmed. But it had been accepted by Laveran, Manson, Metchnikoff, and Nuttall, who at least knew the subject. Was not this enough to justify the expenditure of a few hundred pounds in so great a cause? I mention these facts because it was largely this failure to obtain assistance which drove me from India some months later; which delayed the completion of my work for more than a year, and which postponed the adoption of an energetic prophylaxis in India until the present. Not mine the fault: the truth is that for some inexplicable reason men will never recognise the transcendent importance of investigation into the causes of those great diseases which destroy them.

The rest of my time in this district was spent in making attempts to find a suitable place in the intensely malarious areas at the foot of the mountains for researches on human malaria. This alone was a matter of no little difficulty, as the locality was new to me and I could obtain no accurate information regarding the disease. I worked especially at a place called Punkabari, situated a few hundred feet above the plain. A hospital and plantation existed here, and there was a large village some miles away on the plain. But the results were not gratifying; few dappled-winged mosquitoes could be found, as the rainy season had not yet commenced; while to my grief I discovered that the plague-scare was, if anything, stronger here than in Calcutta. So terrified were the natives, that on one occasion, when one of my men shot a sparrow for me in the village, all the coolies in the neighbourhood ran away for miles into the jungles, costing the planters much money and trouble before they could be induced to return. In fact, I was given to understand

that scientific investigations were not required there at the moment! Indeed, it soon became apparent that I was only wasting much valuable time; and I consequently determined to complete my researches on *Proteosoma* at Calcutta without further delay.

(17) *Calcutta: June—August,* 1898. *The Route of Infection.*—On my return to Calcutta (June 4th) I found it still quite impossible to obtain cases of human malaria for my work, and therefore proceeded at once with the life history of *Proteosoma*. The most wonderful of all the phases of this history was now to be revealed. I had traced the development of the pigmented cells up to their maturity and subsequent rupture and discharge of their contents into the body-cavity of the grey mosquitoes. I could not see at the moment what happened to these contents; yet upon this point depended the vastly important question of the route of infection in malaria. But, when I had broken off my work a few weeks previously, the contents had appeared to consist of little more than a pure fluid.

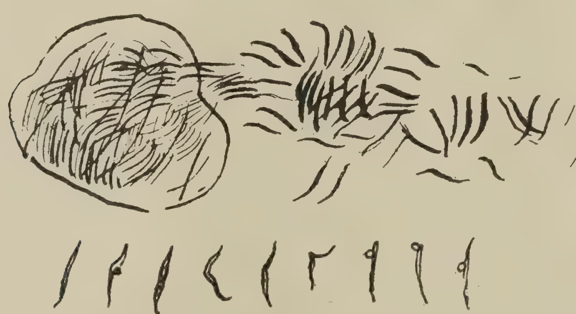

Fig. 4.—Sketch of thread-like bodies (sporozoids or blasts) escaping from mature ruptured pigmented cell (zygote). From letter of Ross to Laveran, dated July 18th, 1898.

Hitherto my mosquitoes had been dissected in water or a weak solution of salt, and I had had no time for methodical staining. A strong salt solution was now used and the secret was revealed. The contents of the mature pigmented cells did not consist of clear fluid, but of a multitude of delicate thread-like bodies, which, on the rupture of the parent cell, were poured into the body-cavity of the insect, and which were evidently spores.

What happened now to these spores in view of the theories mentioned in section 12? Did they escape into the water according to Manson's ideas; or were they voided by the intestine

according to mine; or did they in some mysterious manner work their way into healthy persons during puncture, according to the theories of King and Bignami, and later of myself? But the staff of theory was no longer necessary; plain research would suffice.

Here there was another sharp but short struggle. I saw that the thread-like bodies, although apparently without motion themselves, were soon scattered by the insect's circulation all through its body; but beyond this I could not follow them for some time, in spite of the most assiduous endeavours. They seemed to have been created without object.

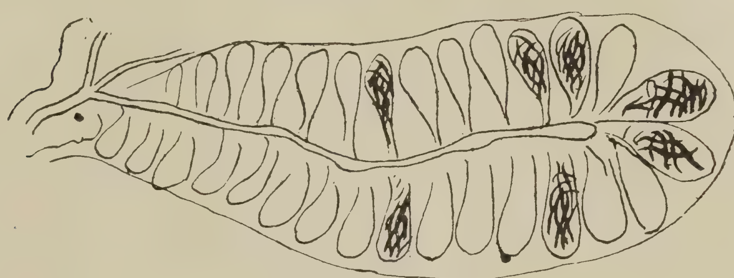

FIG. 5.—Thread-like bodies (sporozoids) in cells of salivary gland of mosquito. From letter of Ross to Laveran, dated July 18th, 1898.

On July 2nd, however, I found in the thorax of a mosquito a large cell which, surprising to state, contained within it several of the thread-like bodies. They were able then to work their way into cells, but what was the cell? On July 4th, while working upon another mosquito, I found that the thread-like bodies seemed to become more and more numerous towards a point in the thorax —as if they were converging toward some destination. At that point there were numerous cells such as I had seen on July 2nd. They were attached to a duct and were all contained within the same capsule—they constituted, in fact, some kind of gland. In all these cells there were hundreds of the thread-like bodies, floating loosely at all angles to each other, like fish in globes of glass. Close by was another lobe of the gland similarly full of the spores. I was at the summit but not on it. I did not know what the gland was. I knew the appearance of the cells, it is true, but in spite of my thousand and more dissections I had by no means acquired a full knowledge of the macroscopical anatomy. I found it by no means easy to meet with the gland again. On July 8th the mystery was

solved. The gland lay in the neck and upper thorax—the throat—of the mosquito. It consisted of three lobes on each side. The ducts of each lobe unite together like the midrifs of a trefoil. The duct so formed runs forward and meets the similar duct of the other side, under the chin—so to speak—of the mosquito. The common duct advances still further, and enters through the round base of the central stylet or stabbing weapon of the mosquito's proboscis. It was easy now to recognise the nature of the gland; it was the *salivary gland*, which secretes the irritating fluid which the mosquito injects in the wound made by her in the skin, perhaps to dilate the vessels, perhaps to prevent speedy coagulation of the blood.[1]

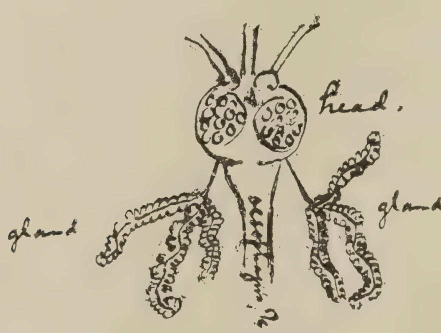

Fig. 6.—Salivary gland of mosquito. From letter of Ross to Manson, dated July 6th, 1898.

The exact route of infection of this great disease, which annually slays its millions of human beings and keeps whole continents in darkness, was revealed. These minute spores enter the salivary gland of the mosquito, and pass with its poisonous saliva directly into the blood of men. Never in our dreams had we imagined so wonderful a tale as this.

But still all this was inference only; the last proof was demanded. If the infection can be given in this way, give it. I had long possessed in the laboratory five old birds—four sparrows and one weaver bird—which had been kept there for my "control" experiments, because they had never been found to contain *Proteosoma*, even after several examinations. On June 25th, as soon as I began to suspect the destination of the thread-like bodies,

[1] This gland had been discovered in 1888 by Macloskie [5], but I did not know it at the time, and still had received no literature on the subject.

these birds were all examined again, and were found to be still quite healthy. On that and the following nights, a large number of grey mosquitoes which had been long previously fed upon infected birds and many of which had been found to contain the thread-like bodies in their salivary glands, were released within a mosquito net in which the five healthy birds were placed. On the following mornings I satisfied myself that the infected mosquitoes had gorged themselves freely on the birds, and then, fascinated by the study of the parasites in the salivary glands of mosquitoes, I forgot all about even this important experiment.

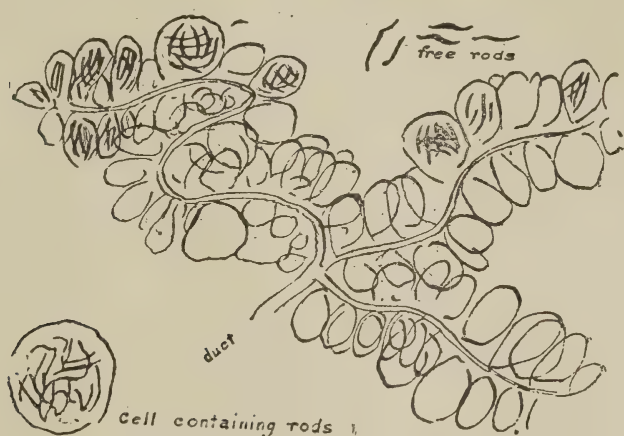

FIG. 7.—Thread-like bodies (rods, sporozoids) in salivary glands of mosquito. Published from Ross's drawing by Manson, *British Medical Journal*, September 24th, 1898, p. 852.

Now only a small percentage of birds in Calcutta are infected with *Proteosoma*. Out of 111 wild sparrows examined by me I found the parasites only in fifteen, or 13·5 per cent. Moreover, even in infected birds the parasites were scarce, seldom more than one being found in each field of the microscope. On July 9th I suddenly remembered my experiment and examined the previously healthy birds. All of them without exception were now found swarming with *Proteosoma*, as many as twenty or even more being found in each field.

But not content even with this I repeated the experiment over and over again; and within the next few weeks I succeeded in infecting twenty-two out of twenty-eight healthy sparrows (79 per

cent.), and also a crow and four weaver-birds, and, moreover, gave a more copious infection to four sparrows which previously contained only a few parasites. At the same time I kept as controls a number of healthy birds in mosquito nets, safe from the bites of mosquitoes, and found that none of them became infected (with one exception, probably due to an error).

Manson, to whom I had sent full details, told me that he would expound all my results, with demonstrations of my specimens, at the meeting of the British Medical Association to be held at Edinburgh at the end of July. I now announced the successful infection of birds to him by a telegram, which reached him just as he was setting out (though ill at the time) for the meeting; and he was therefore able to communicate the complete life-history of the parasites in his address.

His exposition, as Dr. Charles said, " created quite a furore," and was quickly made known everywhere. His papers were published on September 24th [43] and gave a full account of the subject up to the infection of healthy birds, together with several drawings of the thread-like bodies, both free and in the salivary glands, taken from my letters.

It was interesting during these researches to watch the gradual invasion of the birds by the parasites. From five to eight days after they were bitten by infected mosquitoes no parasites could be found in their blood; then a few appeared, then many; and at the last large numbers. The first five birds all died, and so did some of the others; and their liver was found to be full of the characteristic pigment of malaria. But many recovered, the parasites gradually decreasing in number.

At the same time I was temporarily not a little delayed by finding inside the mature pigmented cells certain large brown or black bodies which I provisionally thought might be connected with their life-history. As proved by the researches just described, malaria could be carried by mosquitoes from the sick to the healthy, but as we know, malaria clings intensely to location. It therefore seemed not at all unlikely that these black bodies, occurring as they did actually within the pigmented cells, might be of the nature of sporocysts meant in some way to infect other mosquitoes, so that the infection might not only be carried from man to man by the mosquito, but from mosquito to mosquito; or they might be meant to infect man, as Manson had thought, through the water. It was of course necessary, for sound science, to examine these bodies, and I therefore tried to infect both birds and the larvæ of mosquitoes

by feeding them on insects containing these black spores; but the results were negative. Subsequently I saw reason to doubt whether the black spores really had any connection with the parasites (section 20).

But there was little time for such researches, necessary as they seemed at the moment. Although there could be no doubt that the human parasites have the same history as *Proteosoma*, still it was a necessary formality to complete the partial demonstration of this fact which had been already attained, if only to persuade Government to take active measures against the disease, and I was at last free to undertake the work. But now precisely occurred my last and most annoying interruption.

Before coming to this, however, let us consider the results which had already been attained and which have been the basis of nearly all that has been subsequently done.

(*a*) The general life-history of *Proteosoma* in the grey mosquito and the mode of infection being now ascertained, we could foretell to a practical certainty that the life-history and mode of infection of all the other parasites of the same group, including the human ones, would be closely similar in all their stages; that is, that if they differed at all, they would differ only in small details. The result of this was that if anyone wished to trace the life-history of any of these organisms in a second host he would now find the task an extremely easy one, because (i.) he would know exactly the appearance of the parasite he was in search of, and (ii.) he would know exactly in what part of the anatomy of the second host to look for it. And if he wished to ascertain whether a given animal was or was not the second host of the parasite he could easily make sure of the fact by ascertaining whether or not it harboured the described parasites, after feeding and dissection by the methods laid down by me.

It is, in fact, solely by this means that we have been able to demonstrate the proper hosts of the human parasites in many parts of the world.

(*b*) More than this, the pigmented cells of the æstivo-autumnal parasite of man had been demonstrated to be exactly similar to those of *Proteosoma* on the second, fourth, and fifth days after infection of the mosquito; and the hosts of this important organism were shown to be at least two species of a special genus which could be recognised by its possessing spotted wings and boat-shaped eggs (section 23), and were clearly shown not to be my grey and brindled mosquitoes, the former of which had been described sufficiently for recognition [39 and 42].

(*c*) The important law that not all species of mosquitoes can harbour a given parasite of this group had been established, both with regard to the æstivo-autumnal parasite and *Proteosoma* and *Halteridium*, and several important facts regarding mosquitoes had slowly become evident to me—but were not published until later.

(*d*) Lastly, full directions of *technique* had been given in my report [42]. These consisted of numerous essential details, acquired during several years' experience, regarding dissection and feeding, &c., without a knowledge of which the observer would be very likely to go wrong (as for instance by attempting to section his mosquitoes for searching for the parasites, and omitting to feed them regularly and change their soiled habitations for clean ones).

On the other hand, my researches had given little or no information about the quartan and tertian parasities—except, of course, the all-important analogy with *Proteosoma*. The observation of the grey mosquito caught feeding on the case of tertian was doubtful (section 14). Moreover, they had not directly and absolutely demonstrated the final stages even of the æstivo-autumnal parasites in the dappled-winged mosquitoes, nor the mode of infection. But, nevertheless, they had reduced the demonstrations still required to an easy formality which was within the capacity of any tyro with sufficient material and a microscope.

I am sorry to have to write such a summary of my work as this one; but it is rendered necessary by those who, during the long interruption of my labours which now followed, were able to work out some details of the subject before me, and who have wished to conceal the assured fact that their efforts were simply a repetition and imitation of mine. It should be pointed out that, by a generally recognised zoological rule, the discovery of the life-history of *Proteosoma* in mosquitoes covers that of other members of the same group of organisms, which have precisely the same development. By that rule, the right of priority in discovery belongs to him who first works out the life-history of one species of a group of animals; not to those who merely perform the easy task of extending the known facts to other species. Discovery is discovery; the determination of parallel facts, the filling in of details, the publication of pretty illustrations, and the furnishing of formal proofs of matters which are already certain, are useful, but do not constitute discovery.

My infection experiments on birds were completed early in August, and, as will be related presently, I was now no longer able to defer my work on *kala-azar*. Consequently I was obliged to

leave Calcutta on August 13th, for my new duties, much exhausted by work and heat in the plains. Before doing so, however, I released my host of little feathered prisoners, which had unwillingly been of such assistance in the investigation.

It should be mentioned that from the first discovery of the thread-like bodies I had wondered whether they have any other destination besides the salivary gland. The eggs were especially suspected, but the results of investigation were negative. I therefore now concluded that malaria is communicated *only* by the bites of insects.

(18) *Darjeeling District: August — September,* 1898. *Kala-dukh.*—It was mentioned at the end of section 14 that I myself had proposed to Government that *kala-azar* should be included in the programme of my year's special duty, because I then hoped that this disease might shed light upon the mosquito theory; but now, when the theory was established and it was necessary to press on with the study of the human malaria, I wished to escape this additional duty, as I dreaded lest it should involve me in much pathological work, which would interfere with the principal line of research. I hinted as much to the Director-General, but was told that he expected me to adhere to the programme. The disease was exciting much comment because it was new and was taking some thousand lives annually in Assam; but it was forgotten that malaria, though it is not new, takes some millions of lives annually in India alone.

Harold Brown had recently studied a disease which existed at the foot of the Darjeeling mountains, and which was called *kala-dukh* (black sickness) and was evidently closely allied to *kala-azar* (black fever). Consequently I obtained permission to investigate this disorder first, partly because an opportunity might be afforded me of making some further studies at the same time on malaria n my old haunts at Punkabari. Fixing my headquarters at Kurseong in the hills on the road to Darjeeling, I made numerous visits to this locality, but was dogged by ill-luck. The plague-scare, though waning, was still present, and difficulties of transport impeded the work. On August 25th I arrived at Naxalbari, an intensely malarious plantation and village on the plain beyond the foot of the hills, and found swarms of small and large dappled-winged mosquitoes (probably *Anopheles listoni* and *A. rossi*). There was no time to make formal experiments, and the people would not have allowed them, but I examined some dozens of these mosquitoes caught in the houses of infected persons, both for

the pigmented cells and the thread-like bodies, but without success.[1] Nearly all my time was, however, taken up in pathological enquiries on *kala-dukh*—as I feared would be the case. But now it was no longer possible to postpone the evil hour without dereliction of duty, and I was obliged to set out on the long journey to Assam.

(19) *Assam: September — November*, 1898. *Kala-Azar.* — I arrived at Nowgong, the centre of the epidemic of *kala-azar*, on September 13th. It was at once obvious that my worst fears were well founded, and that I would be plunged for months into a difficult pathological problem and a long pathological report. But the work was not without interest, and I may be pardoned for touching upon it briefly. The disease had been first noticed by McNaught in 1882. A few years later the Government sent Giles to investigate it, and Giles, who probably did not come much in contact with the real disease, seemed to have been considerably misled, and in a report (which was nevertheless a very able one) pronounced the malady to be ankylostomiasis [77]. Many of the practitioners in the locality were not satisfied, however, and in 1896 Government sent Rogers to make a further report. Rogers certainly saw the real disease and concluded that it was a virulent form of malaria [78]. As it was evidently communicable, this implied that he held malarial fever to be communicable—a thing which no one would believe at that time, but he maintained his opinions with great courage and success. I was now sent in order, if possible, to decide the question, and as my researches had shown that contrary to accepted views malaria must be communicable from the sick to the healthy, Rogers' position was justified. But the exact nature of *kala-azar* still required definition, and as I was called upon to judge between opposite opinions, I was forced into a tedious enquiry—though it was my immediate personal impression that the disease is malaria.

Mixed with the cases of *kala-azar* there were numerous cases of ordinary malaria, and I found that the local practitioners could not distinguish which was which until the cases became exceedingly severe, when they were declared to be *kala-azar*. This generally happened only in the later stages of the cases—so that in fact *kala-azar* seemed to be simply another name for a very severe and

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[1] How unfortunate I was in this respect may be gathered from the papers of Stephens and Christophers [71] who later found a large percentage of these mosquitoes infected in this very district.

frequently fatal form of malarial cachexia. As, moreover, many of the patients had ankylostomes, those who are familiar with the subject will understand that my task was indeed a complex one. The plague-scare not having penetrated here, I attacked the problem by examining the blood of all the cases, both of malaria and of *kala-azar*. My results showed that while the parasites were easily found in the early cases, they became more and more scarce as the disease advanced; until, in the old typical cases of malarial cachexia and *kala-azar* neither parasites nor pigment were to be found, even in blood taken from the spleen. I inferred then that *kala-azar* is probably only malaria, though it was possible that some secondary infection might account for the gravity of the cases. I also inferred—what no one would accept before then—that the spontaneous disappearance of the parasites must be due to the gradual establishment of immunity, and that the low fever present in these old cases was due, not to the parasites, but to some secondary intoxication from the greatly enlarged liver and spleen. And the same theories seemed to me to apply to *kala-dukh*.[1]

This investigation required repeated examination of the blood of all the cases which I could procure in the town; and, being made at high pressure, involved another extreme strain on the eyesight. Nevertheless I examined several batches of dappled-winged mosquitoes fed on cases with parasites, but the insects selected for the work were like some of those abounding at Calcutta, namely, *Anopheles rossi*. All proved negative. My disappointment was considerable, but I was not satisfied that the feedings, which were left to assistants, were properly done. Many of the same insects caught in the houses of patients were also negative. By the aid of my assistants, however, many fresh examples of the law that the dappled-winged mosquitoes breed in pools of water on the ground were obtained.

During my stay at Nowgong I wrote a short report, dated October 11th, on the infection of birds by the bites of mosquitoes [46]. This was not published until some months later; but of course the principal facts had long previously been published by Manson [43].

At the conclusion of my work on "Kala-azar" I returned, now utterly exhausted, to Calcutta.

(*To be continued.*)

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[1] It has just become highly probable that these diseases are due to a new parasite recently discovered by Leishman and Donovan.

SOME MEDICAL NOTES ON WAR.

By Captain E. BLAKE KNOX.
Royal Army Medical Corps.

(*Continued from p.* 446.)

II.—Our Duties on Mobilisation.

Mobilisation of a Field Force.—In the mobilisation of troops for active service in the field, especially for a tropical campaign, the selection, not alone of units, but also of the individual, is of such vital importance as to be what we may almost term the key to the position of success. Many factors enter into the consideration of this question, of which the following are, perhaps, the more important. As elsewhere alluded to,[1] any regiment or other unit that has been noted for its sanitary conservancy in barrack life in peace time may be relied on to carry such an attribute with it into the more severe test of active service, and *vice versâ.* For, a regiment that is careless of its hygiene in peace may of a certainty be prophesied to fall to pieces with enteric fever or other dirt disease in war. The question also of units shattered and decimated by venereal disease or malarial fever will always arise, and, if the individuals debilitated by these diseases be not thoroughly eliminated by strict medical examination prior to disembarkation, they will fill the hospitals on field service and paralyse any regiment from wastage. Such regiments will be a delusion, and their strength a paper one, and, as they will only reflect the utmost discredit on all concerned, they should never on any occasion be allowed to take the field; it is far better for the officer in medical charge of such a unit to stick to his guns and strenuously oppose any attempt for it to do other than garrison duty at home. Its officers and men that are "fit" should get opportunity for transfer to staff or other extra-regimental appointments as volunteers for the seat of war, so that disappointment need not ensue. Passing next to examine the individual, I will now endeavour to express my views briefly and broadly, as it is of course impossible to lay down hard and fast rules suitable for all cases, as each must, of necessity, be judged on its own merits.

Age.—The short service system initiated by Field-Marshal Viscount Wolseley, as is well known, gives us a larger proportion of young soldiers in the Army than we would have otherwise had;

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[1] *Vide* Journal of the Royal Army Medical Corps, vol. iv., page 440, "Our Duties in Barracks," by Captain E. Blake Knox, R.A.M.C.

so we have but little choice when it comes to mobilising a large field force, even when taking into consideration the men of the Army Reserve. Lord Wolseley's views in respect of the value of the young soldier are well known and common property; he deems young non-commissioned officers also as important an essential as young recruits.

The history of Napoleon's campaigns, and those of the other great Continental powers, as well as that of our own, all give overwhelming evidence of the fact that old and seasoned troops are much the best. From personal experience, and from the closest possible attention to this subject while attached to units which were invariably employed in the fighting lines during General Buller's handling of the Natal army in the general engagements at Spion Kop, Vaal Krantz, Colenso, Pieter's Hill, Relief of Ladysmith, Laing's Nek and Belfast, as well as in numerous engagements of lesser importance in Natal, Orange River Colony and the Transvaal, in which I had a fair opportunity of estimating and reflecting on the value of the influence of age on the health and efficiency of the soldier of all ages from the recruit to the seasoned soldier and reserve man; of contrasting home-bred and colonial, regulars, irregulars, yeomanry, volunteers and militia, I have no hesitation in stating that, from a purely *medical* point of view, I consider it a mistake to select any man under 25 years of age for active service, *if it is possible* to get more mature men, as the former are invariably bound to break down in a protracted campaign, sooner or later, from overstrain and fatigue, and knock under to enteric fever, dysentery, or some other disease. From a military point of view, however, I must state that it is my humble opinion that more dash and more initiative in times of emergency was found among men of under 25 years than among the men of more mature age, such as belonged to the Army Reserve; perhaps this may in some part be due to the fact that the latter, having contracted home ties and settled down from army life, have, to some extent, become softer in muscle and more cautious of limb. I mention this, for I believe if we strike a mean between the age of the recruit and that of the Army Reserve man we have the right material for war as British soldiers; for such men should have all the advantages of seasoning and few, if any, of the susceptibilities.

It is hardly necessary to remind our readers that experience in war, and also in peace, has taught us Army surgeons the bearing that age has on the susceptibility of the soldier to infection from enteric fever, which we must grant is the bugbear of disease we have had, and always will have, to face on active service. Men

between the ages of 20 and 25 are by far the most susceptible to this disease, as they have not yet matured and ceased growing until that age has been reached. Examples of immaturity may be found in the bones of the skeleton, many of which are not wholly united; moreover, the heart, lungs and viscera have not matured until the individual has attained his 25th year. The present short service system robs us of seasoned soldiers; by "seasoned" men I mean the survivorship of the fittest, that is, men with their weaker comrades weeded out by the effect of tropical service. I do not mean men who have had tropical diseases, such as malarial fevers or dysentery, as such individuals are especially predisposed to further attacks on the least exposure. The majority of our recruits under the present short service system are under 20 years of age; they do not remain sufficiently long at home, and are sent abroad before they are matured. Under the new, easy-going and attractive surroundings of a foreign station, these men, one and all, at some period of their first few years' service, contract venereal disease, malarial fever, or enteric, or perhaps a combination of these diseases, the result being that these diseases, after eliminating the weaker individuals, leave the best educated of the remainder to be promoted to the rank of non-commissioned officers, and these in turn are discharged from the service just as they reach the age and period of seasoned soldiers. Any one has only to take the medical history sheets of a regiment *en bloc* and go carefully through them, when the truth of these statements will be apparent. In Lord Roberts's great march from Cabul to Kandahar the effect of age and seasoning in soldiers was well brought out; all the regiments engaged marched well and improved daily, all, except the 72nd; on enquiry it was found that the marching power of only a limited section of this regiment was affected, and that these companies were made up of newly-arrived drafts of young men. In Natal I noticed very much the same sort of thing. During General Buller's forced marches from Ladysmith and Elandslaagte to Laing's Nek, *via* Helpmakaar, Dundee and Newcastle, the Light Infantry Brigade, which acted as advanced guard to the main army, covered distances varying between twenty and twenty-five miles daily; the troops were all seasoned, save for drafts and volunteer companies that had come out from England, and when men fell out they were invariably found to be recent arrivals. On the other hand, the Lancashire Brigade, to which I was for some time attached, were second to none as a fighting unit, but were notoriously slow marchers, chiefly owing to the large number of reservists they counted in their ranks.

Let us now consider what is the age most suitable for active service. Sir Thomas Crawford, a former Director-General of the Army Medical Department, fixed the lowest limit at 23 years of age. The Army Sanitary Commission, in reference to Indian trooping, advised that no one under 25 years should be sent to India. The French Foreign Legion in Algeria is composed of only seasoned troops. These, and many other instances, all point to the fact that there can be no possible doubt that 25 is the age we must circle round, preferably over 25, as the most suitable for campaigning in the Tropics.

Previous Medical History, and its Bearing on Selection for Active Service.—In the medical examination of the men of a regiment detailed for active service, the medical history sheets of each individual must be carefully scanned while they are subject to examination. All cases with lengthy hospital admissions for venereal disease or malarial fever must be particularly gone into, and, *as a rule,* should be rejected as unfit, as the efficiency of a field force depends on the efficiency of the men composing it, and there are no diseases more prone to return, or induce debility from functional disturbances of the heart and circulation, than malarial or venereal affections. Cachetic and anæmic men, with past histories of malarial fever, should *invariably,* for this reason, be rejected, as they will break down in the first few weeks of any campaign. In the very first march the Lancashire Brigade made in South Africa, from Chieveley to Frere, a good example of this came to my notice. We started from Chieveley at 3 a.m., before dawn, and amid torrents of rain, over tracks covered with mud and slush, the Brigade marched until 5 p.m. in the afternoon. Most of the troops had no great coats, having left them in the waggons. The ambulance waggons of the Brigade Bearer Company (Major T. B. Winter's) were filled to their fullest extent, the majority of the patients being reservists, in whom the quiescent germs of malaria had been called again into activity by the cold and rain. They presented a pitiable spectacle as they lay, cold and shivering, wrapped up in the Government blankets provided by regulation in every Bearer Company's equipment. All these cases had to be admitted to hospital on arrival at Frere, and all had more or less copious histories of previous attacks of malarial fever; these men had only been in the country a week, and were useless as soldiers for active service. Many of them had to be invalided at once. Venereal disease is another most important factor to take into consideration while estimating the value of men for active service. Needless to state, no case of primary sore or gonorrhœa should be allowed to embark, as even for prophylaxis

sake, every channel of origin of any infectious disease must be eliminated from the country which troops propose to fight in. During the physical examination as to fitness, this matter will naturally have to be attended to by the Medical Officer. He should also form some estimate from the man's medical history sheet as to his previous admissions to hospital for venereal disease, and reject all cases of syphilitic cachexia, anæmia, and chronic orchitis, as such cases invariably break down.

Physical Examination.—Having glanced over the medical history sheets to estimate the two diseases, malarial fever and venereal disease, and having eliminated entries for any other serious disease, the Medical Officer can pass on to the physical examination of the man himself. This examination must be as thorough as time will allow. The system I have myself adopted on occasions where I have not had the advantage of the assistance of one of my brother officers, and where time and the exigencies of the service did not permit of what should, perhaps, have been careful examination, was as follows: A company was paraded at a certain hour, the Colour-Sergeant of the same handed me a nominal roll, giving the men's names, numbers, and initials, and also their medical history sheets, arranged in the same order as they appeared on the roll; the men were marched into the room (as large a one as possible is advisable) in batches of ten, each man had nothing on but his shirt and overalls. The men were arranged in file at wide interval. The front row took off their shirts, and, as each man's turn came for examination, he let fall his overalls, so that the entire body was seen in turn. Special attention was paid to discharges from ears, to blepharitis, teeth, heart, rupture, venereal disease, varicocele, varicose veins, deformities of feet, and piles. In examining for rupture, each man's abdominal rings were examined, and he was made to stand on tiptoe and cough; and for piles, to stoop and touch his toes. To avoid personation, the Company Colour-Sergeant stood by, and each man was asked either his number, initial, or place of enlistment, or some other question from his medical history sheet; his power of hearing also was estimated by this question.

I will now by a few brief notes endeavour to give my opinion as to the degree of any of the above-mentioned defects that can be passed. No case of perforation of the membrana tympani ought to be sent on service; cold and exposure only aggravate it, and its danger to life will be increased. This disease is particularly common amongst the Royal Artillery, and especially the Royal Garrison Artillery; in the Royal Artillery it is usually caused by duty; in

other branches of the service it is usually the result of carelessness in drying the ears after a plunge bath or washing.

Blepharitis is an eye trouble very prone to increase and lead to conjunctivitis on service, especially in dusty or sandy Tropics: if this disease is at all markedly present, or if there is absence of many eyelashes, such a soldier ought not to be allowed to go on service. The question of teeth is a more difficult one, and, when on service, really depends on the keenness of the individual for soldiering, for I have seen men in a campaign get along in perfect health with a most limited supply of teeth; and I have seen others readily go sick on the smallest excuse, and proclaim their inability to eat field rations. As a rule, no man without a good bite of at least four opposing molars should be passed, and all signs of caries with suppurating fangs ought to be rejected. Too much weight need not be attached to carious incisors. The question of artificial teeth is doubtful, and I would be disinclined to reject a candidate if otherwise satisfactory; but we must always be suspicious of the worth of such individuals, as they have only to lose their plates and claim exemption from all duties. Non-commissioned officers, as a rule, should be passed at a lower standard as regards teeth than privates. Each and every candidate with any form of cardiac murmur must naturally be rejected at once, and the same rule will hold good in organic disease of the lungs or other viscera.

Venereal disease has already been dealt with, and the rules laid down should be rigidly enforced. No case of rupture, however slight, should be passed, as the tendency to increase is always present. Rupture cases wearing trusses should also be rejected, as carrying stones for *sangars* will bring on a relapse. Mild cases of varicocele and varicose veins cannot be stopped, as such a large proportion of men have them; pile cases, on the other hand, should not be allowed on service, as they will never tend to improve, but rather tend to get worse. With regard to feet troubles, no marked cases of bunion, hammer toe, or flat foot should be passed, as marching is of cardinal importance, and if men have any excuse in the shape of deformity of toes, they will continually fall out on the march, and fill the ambulance waggons.

Finally, on mobilisation the following should hold good:—

(1) It is imperative that the Medical Officer in charge of a unit, in peace time, be detailed to examine this unit individually as to fitness for field service, and that this examination be carried out in a most thorough fashion. In the Boer War many were sent out who were utterly unfit for war service.

(2) The Medical Officer in charge of a unit in peace time, and no other, should invariably be detailed to accompany it in war, he will thus know the temper of its officers and men, and such experience is invaluable.

(3) On mobilisation the bandsmen of the regiment should be handed over entire to the Medical Officer for special training in first aid and sanitation.

(*To be continued.*)

THE DIRECT TRANSMISSION OF ENTERIC FEVER, AND ITS PREVENTION BY THE "STAMPING OUT" METHOD.

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In Murchison's "Treatise on the Continued Fevers of Great Britain" we read: "Although enteric fever is communicable, my experience is entirely opposed to the view that it is contagious in the strict sense of the term. Visiting, or contact with, the sick is neither sufficient nor necessary to produce it, and it is never propagated by a third person." And Dr. W. Cayley supplements this by saying that "although it may not be safe to affirm that enteric fever is incapable of being communicated by direct contagion, it is quite certain that this plays a very small part in the dissemination of the disease, and that widespread epidemics are never due to this cause" (*op. cit.*, third edition, 1884, p. 466). As a recent expression of opinion may be quoted that of Schuder (*Zeitschrift f. Hygiene*, 1901, xxxviii., p. 343) who, having studied the records of 638 epidemics in different countries, in which the cause and manner of spread appeared to be satisfactorily established, states that 70·8 per cent. of these outbreaks were due to drinking water, 17 per cent. to milk, 3·5 per cent. to food of other kinds, and the remainder (8·7 per cent.) to all other causes, dust, fomites, &c. Direct infection was particularly enquired into, and appeared to be answerable for 1,179 cases out of a total number of 35,647, *i.e.*, 3·3 per cent.

In spite of the preponderance of drinking water as a cause of epidemic spread, the extreme rarity of the instances in which the specific bacillus has been detected in water is well known. It was apparently the consideration of this fact, and a close study of the conditions obtaining in several outbreaks that occurred in Westphalia and on the Franco-German frontier during the years 1898-1902, that induced Koch to enter on his campaign against enteric fever ("*Die Bekämpfung des Typhus*"), an exposition of which he gave in Berlin, November, 1902, and which has since attracted so much attention. The following account is derived chiefly from a valuable paper by M. Talayrach, Médecin-Major de premiére classe (La Lutte contre la Fièvre Typhoide) in the *Archives de Medecine et de Pharmacie Militaires,* xlii., 1903.

I.—The Stamping Out of Enteric Fever.

During the years 1898-1902, the German Government was much exercised at the frequency of typhoid epidemics in its western provinces; in the Ruhr basin in Westphalia, and in the Sarre basin in the Rhine Province. Nearly all were manifestly due to water. In 1898 occurred an outbreak of 883 cases at Haspe-Gevelsburg (Westphalia); in 1899 one of 1,282 cases at Bochum and Gelsenkirchen, where also there were 1,360 cases in 1900, and 3,516 cases in 1901; like these outbreaks in the Ruhr basin, others occurred in the basin of the Sarre, where the disease, dying out in one spot, started afresh in another, then became endemic in some parts of the Rhine province, and extended to Alsace-Lorraine. Not only were the industrial populations of Sarrebrück, Treves and Sarrebourg attacked, but the frontier garrisons also suffered severely at Sarrebrück, Sarrebourg and Strasbourg. The military medical authorities on their side feared an increase in the typhoid morbidity, which had stood at a satisfactorily low figure ever since 1870.

The Government accordingly called in Robert Koch to conduct an enquiry and to advise as to the measures to be taken to combat the disease.

Since the abandonment by the majority of German writers of Pettenkofer's ground-water theory, the causes of an epidemic have been considered to be either: (1) Infection by water; (2) infection by food; or (3) infection by contact. The morbidity curve presents a characteristic aspect, according as one or other of these causes comes into play. An outbreak due to water furnishes at the beginning, after a few days' ascending oscillations, a sudden *fastigium*, the sharper and more elevated according as the pollution has been more abundant. Food epidemics have the same characters, but less pronounced. It is altogether different when the outbreak depends upon contact infection; the graphic tracing shows a level prevalence, but slightly elevated, and with little variation, and is often prolonged over several months.

The 1901 epidemic at Gelsenkirchen (Westphalia) was a typical water epidemic to begin with, followed by a prevalence due to contact. The first cases occurred on August 27th, the curve mounted by oscillations to its maximum on September 10th, and then rapidly sank, as if the outbreak was going to cease, the fall corresponding with the closing of the incriminated source of water supply. Nevertheless the epidemic dragged on, with a continuous but little elevated curve until March, 1902; this continuance being

due to contact infection from scattered foci, which gradually came into existence.

The 1898 food epidemic at Sarrebrück (due to a contaminated potato salad) was also followed by a contact prevalence. On January 4th seven cases were notified, the next day 37; after this the curve fell rapidly, but nevertheless the epidemic continued until February 24th. It is noteworthy to remark, twenty-four days after the infection by this article of food, admissions for typhoid fever were still going on, although obviously the salad could no longer be put down as the cause. It is evident that one must refer to contact infection all the admissions after the first three weeks.

An exclusively contact epidemic, characterised by its curves, was seen in a battalion of artillery at Strasbourg in 1900; by working out the different foci of infection, Musehold was able to demonstrate the "filiation" of all the cases; their origin was either the use of a latrine in common, or a common barrack-room.

It is known that the typhoid bacillus can live outside the human body; for instance, Uffelmann has shown that specifically soiled linen and woollen stuffs kept their virulence for sixty days, dry earth twenty-one days, fæcal matter thirty days. But the German bacteriologists maintain that longevity of the typhoid germ is *not the rule* outside the human body, and that under these conditions its virulence rapidly diminishes. The fact which, more than anything else, causes Koch and his school to regard the human organism as *the best* culture medium, is the extreme rarity with which it is possible to demonstrate the presence of Eberth's bacillus in water. Koch himself, having examined the manifestly contaminated water supplies in most of the extensive typhoid epidemics in Germany, has but seldom been able to discover the bacillus. This may be owing to the difficulty of its isolation in part; in part to lapse of time between the infection of the water and the examination of the sample; in part to the shortness of the survival in water of this bacillus. Koch, in fact, has come to the conclusion that it is not a very frequent inhabitant of water, and that its existence therein is of very short duration—perhaps for a day, or even for a few hours only. If it were otherwise, it would be easier to demonstrate its presence; and the ascending curve of morbidity would be followed by continuance of elevation (a "plateau") corresponding to the length of sojourn of the micro-organism in the water. The rapid fall of the curve, and the continuance of the morbidity at a *low level* for weeks and months after the use of the incriminated water has ceased, point clearly to the operation of the third factor in transmission—contact.

Although always acknowledged to be possible, this mode of transmission has often been neglected. The supposed immunity of attendants on the sick has been adduced as an argument against the contact theory. But statistics show that this is not the case; as at Sonderburg, where one case infected six members of the medical *personnel* and ten other patients; at Metz, 1879-81, an epidemic in the hospital comprised twenty-six cases, thirteen of whom were attendants; at Strasbourg, twenty-six cases out of eighty-three originated in hospital. In the period 1881-89, of the total typhoid cases in the German Army, ninety-eight originated in hospital, being 6·3 per cent. of all the typhoid admissions.

Amongst the cases of direct contagion would be included those in which it occurs through linen and clothing. Still, the danger would not be great if direct contact only were concerned. But this is not the case, and the rapid extension of an epidemic is often the result of the dissemination abroad of bacilli proceeding from an enteric patient.

It is the human body, in Koch's opinion, either suffering from typhoid fever, or convalescent after it, or that has been in contact with a typhoid patient, that is the starting point of all typhoid infection. The bacillus is an "obligatory human" bacillus, obligatory to the sick man, or the healthy man, or the associates of the patient. So that the campaign against typhoid will commence, not as formerly by search for the micro-organism in water (where it is almost certain not to be found), but with the patient, with everyone who has come near to him, in everything that has touched him. Destroyed at its origin, and in its original home, the infective germ will no longer be able to contaminate water and food, or to propagate itself indefinitely and bring about epidemics.

When Koch, in 1901, started on his investigations, having in view the idea just mentioned, of the contagiousness of the person, and considering also the great frequency of the mild, ambulant forms of the disease, he applied himself above everything else to the discovery of a *rapid means of diagnosis.* Hitherto the demonstration of the bacillus in the fluids of the body had been laborious, and often negative, even in cases that clinically were beyond doubt. The agglutination method of Gruber and Widal does not give a certain result for the first week, especially in slight cases; and it is these ambulatory cases that, according to Koch, constitute the great danger. After a year's research by Koch and his fellow-workers, Drigalski and Conradi succeeded in preparing a favourable culture medium, which allows of an almost certain diagnosis after the first

twenty-four hours. The medium is a lactose litmus agar containing crystal violet (which is said to inhibit air-organisms, &c.) ; typhoid colonies are transparent—*coli* colonies turn the litmus red. Suspected colonies are identified by Gruber's agglutination test, and with glucose agar and neutral red. The diagnosis can be completed in twenty-four to forty-eight hours.

To have undertaken the campaign in one of the large centres of population where the disease makes its ravages year after year, such as the Westphalian towns of Arnsberg, Bochum, or Dortmund, would have been a Sisyphus's task; Koch preferred to make a beginning, in the spring of 1902, in the villages of the Hochwald (Rhine Province), Waldweiler, Schillingen, &c.

The hypothesis of a water infection could be put on one side in the Waldweiler instance, where eight cases first attracted the Commission's attention. There seemed to be no connexion between the cases notified at the beginning and those supervening later. To establish their relation, Professor Frosch constructed a table with fifty-two vertical columns for the fifty-two weeks of the year. On one horizontal line he plotted a curve of the cases notified in each week; on another line, the cases sought out and found to give a Widal reaction; on a third line, the cases in which subsequent enquiry led to the diagnosis that they must have been typhoid. Thus he found that a chain was formed, the lacunæ in which were filled in by information gathered from the school, the insurance societies' registers, and the registers of the local authorities. At the school account was taken of all children who had been absent at least five consecutive days; the blood, both of the children and of their parents, was examined by the agglutination method; the fæcal matters were tested. From the registered causes of death, Frosch was able to track out cases in the families of the deceased, and so establish long chains of connexion. From the insurance registers he found that there were numbers of persons who had drawn sick pay for eighteen, twenty and twenty-one days' confinement to bed, due to febrile gastric trouble, intestinal hæmorrhage, influenza, bronchitis, pneumonia, &c. With the exception of external injuries, *all the cases of fever were considered to be suspicious*, for the bacteriologist; and, in fact, Widal's reaction often revealed cases of recovered typhoid amongst the insured persons.

A particularly interesting fact brought to light in the study of this outbreak was the extreme frequency of typhoid among infants, and their importance as infective agents; of 154 cases in Waldweiler there were eighty-six between 1 and 5 years old, forty-

seven from 15 to 30, nineteen from 30 to 40. Frosch remarks that, on separating the sex incidence, females were found to suffer more than males (contrary to what is usually found), the explanation being afforded by their more frequent and close contact with the children.

In all these cases direct infection from person to person could alone be the cause. In no way could the water be incriminated. Attacks were seen to succeed each other at regular intervals within the limits of the incubation period. The poorest dwellings, those in which the beds were fewer than the occupants, were most especially attacked. Fæcal matters, dropped about everywhere, had most probably acted as the vehicle of the specific germ, which had been brought back to the interior of the houses on the feet.

Isolation, gratuitous treatment in Dœcker huts, rigorous disinfection of typhoid foci, supervision of convalescents and of the parents of the sick (whose excreta and blood were bacterially examined twice a week) had for their result the disappearance of the bacilli in the dejecta of the persons supervised (and consequently of the disease) at the end of three months. Six months later it had not re-appeared, although in other districts the annual recrudescence had occurred in the spring.

The campaign in the Hochwald has been the first experiment, one might say the touchstone, in the inauguration of a systematic attack on typhoid fever prevalence. The results appeared to be so conclusive that, before the end of 1902, the Government elaborated a series of measures relating to public health, in order to second the efforts of Koch's scientific commission. It was evident that the labour would have to be distributed, and that the local authorities must come to the aid of the scientific commission in order to make their efforts fully successful. Accordingly, in December, 1902, rigorous measures were undertaken by the authorities of the district of Treves.

The three points to be laid down by regulation are, according to Dr. Schlecht, *Medicinalrath* at Treves :—

(1) Notification of the disease.

(2) Isolation of the patient.

(3) Disinfection.

Compulsory notification is a *sine quâ non :* at Treves it had been brought into force since November, 1900. The diagnosis of suspected cases has been made by the scientific Commission ; the materials to be examined—fæces, blood, urine, expectoration—are sent by post by the district medical practitioners to the Commission,

who in due course inform them of the result of the examinations. An important part of the duties of the local government medical practitioners is the instruction, in concert with the school inspectors, of the educational staff of the district in the methods of transmission and prevention of the disease. Another important point is the system of mutual notification that is in force between the civil and the military authorities; the military inform the civil health authorities of all cases of men *going* on leave, when convalescent after typhoid ; and of any cases occurring in a garrison among men lately *returned* from leave.

Isolation of the sick is as important a preventive measure as notification. By the regulations, absolute isolation is not required for the entire dwelling, so long as the sick room can be isolated and have a separate entrance. The best isolation is always the "hospitalisation" of the patient. But the law does not require this. All that can be done is to invite the patient to come into hospital, pointing out the danger that exists for the other inmates of the house if he refuses. If the patient is not brought to hospital, efforts are made to secure the attendance of a professional nurse.

Disinfection is carried out thoroughly, attention being directed to the necessity of dealing with all the dejections during a sufficiently long period after recovery. Preference is given to a strong solution (5 per cent.) of the *Liquor cresoli saponatus* of the German Pharmacopœia ; fæces, vomit and urine are to be well mixed with this solution and allowed to stand for one hour before being put down the drain. Milk of lime and chloride of lime are also recommended.

In addition to the above measures of *direct* attack on the disease, the Government are carrying out various measures of *indirect* prevention, such as providing fresh water supplies, improving those in existence, regulating the removal of refuse matters and excreta, supervision of food supplies (especially milk), of public baths, &c., &c.

The following is an outline of the procedure employed in the important matter of making the diagnosis, or detecting doubtful cases of the disease. The substances sent to the laboratory for examination are :—

(1) Fæcal matters : 50 to 100 cc. if liquid ; of the size of a nut if solid.

(2) Urine, 500 cc.

(3) Blood, taken by scarification of rose spots.

(4) Expectoration from the lung.

(5) Pus, or inflammatory exudations.

(6) Blood, taken (*a*) by puncture of an arm vein (2 or 3 cc.); (*b*) from the lobule of the ear.

(7) Soiled linen.

(8) From a dead body; intestinal contents taken from above the ileo-cæcal valve, portions of spleen, lung, some bile, contents of abscess, pulmonary secretion.

(9) Well water, after the well has been stirred up, from 3 to 5 litres.

The operations to be performed are: cultivations, agglutination test, Pfeiffer's test.

(1) *Cultivations.*

(*a*) Substances 1, 4, 5, 7 and 8. At least two series of large Petri dishes are plated with Drigalski-Conradi medium, incubated at 37° C. for eighteen to twenty-four hours.

(*b*) *Urine.*—Centrifugalise and cultivate from the deposit as (*a*).

(*c*) *Blood.*—Inoculate into alkaline peptone bouillon, using 10 cc. tubes for No. 3, and 150 cc. flasks for No. 6. Incubate at 37° C. for twenty hours, and sow into Petri dishes as (*a*).

(*d*) *Water.*—Place in a 2-litre flask. Add (for 2 litres of water) 20 cc. sterilised solution (7·75 p.c.) of hyposulphite of soda (German Pharmacopœia). Mix. Add 20 cc. sterilised solution (10 p.c.) of nitrate of lead. A deposit is obtained, either by centrifuge or by sedimentation for twenty-four hours: pour off supernatant water, add to the deposit 14 cc. sterilised solution (100 p.c.) of hyposulphite of soda, shake, and decant into a small sterilised tube; allow the insoluble matters to settle. With the liquid portion prepare Petri plates (2 to 5 cc. in each) as with fæcal matters. Colonies are examined with the naked eye by daylight, as to their size, colour and transparency; those suspected of being *B. typhosus* (which are small, transparent, blue-violet in colour) are examined macroscopically, afterwards under a low power, as to their behaviour in the presence of a strongly agglutinating serum. Pure cultures are then made on sloped agar.

The final determination is made (*A*) by examining the shape and motility of the organism; (*B*) cultivation in glucose agar; (*C*) in litmus whey; (*D*) on potato; (*E*) on gelatine; (*F*) agglutination test macroscopically; and (*G*) by Pfeiffer's test.

(2) *Agglutination Tests.*

For the determination of a suspected colony or pure culture, these are carried out (*a*) in hanging drop with direct addition of serum; and (*b*) in dilutions of $\frac{1}{50}$, $\frac{1}{100}$, $\frac{1}{500}$, $\frac{1}{1000}$, and $\frac{1}{2000}$, each experiment being repeated with the same culture and the same dilutions, and with a known typhoid culture of the same age and the control serum. For the examination of the blood, a microscopic test is made with $\frac{1}{50}$ and $\frac{1}{100}$ of the suspected serum and a forty-eight-hour typhoid culture; macroscopic examination is also made in conical tubes, left for three hours at 37° C. If $\frac{1}{50}$ gives positive reaction and $\frac{1}{100}$ negative, the case is doubtful, and the test should be repeated a few days later.

(3) *Pfeiffer's Test.*

The serum employed must have a strong agglutinating power. Four guinea-pigs are taken: A receives a five-fold immunising dose; B a ten-fold dose; C is a control, receiving a fifty-fold dose of normal serum; these animals are injected with doses of serum containing a loop of the culture to be examined (eighteen hours on agar, and then diluted with one cc. bouillon). D receives an injection of a quarter of a loop of the culture simply, this serves as a test for its virulence. The peritoneal exudation is examined in hanging drop under a high power from twenty minutes to one or two hours after the injection. With A and B the bacilli should be dissolved or transformed into granules; with C and D a large number of bacteria should be quite motile and retain their characteristic form.

In the application of the *campaign against typhoid* to military practice, the examination of water supplies is not to be omitted. This mode of infection may be stopped in some degree if a bacterioscopic water examination is made at regular intervals, *not* to discover the enteric bacillus, which practically is never found there, *but* to ascertain the presence and amount of colon bacilli, which are the proof of fæcal pollution, and an indication of possible contamination by Eberth's bacillus. In Koch's opinion, no filter can safeguard against this danger of infection by water, sterilisation is the only way to do so.

When a case of typhoid appears in a barrack room, whether it be of alimentary origin (water, vegetables, butter, milk), or whether

it depends upon contagion (return from furlough, children of families living outside barracks, latrines, hospital), isolation of the barrack room mess should be carried out immediately, in spare quarters in the barrack kept apart for this purpose. The men under observation live, take their meals, exercise, and use latrines apart from the rest. Their stools and blood are examined bacterioscopically; and life in common is not resumed until after a lapse of time equal to the incubation period of the disease.

In this way Conradi, Drigalski and Jurgens cut short an epidemic of paratyphus at Sarrebrück in 1902, the first example, on a large scale, of "bacteriological prevention" in the army. In the 2nd battalion of the 70th infantry nineteen men were admitted to hospital with slight diarrhœa; at first, influenza was suspected, but when enteric fever was considered to be possible, and when the bacillus was discovered in the stools of one of the patients, the scientific commission extended its researches, and the Surgeon-General of the 8th Corps caused similar examinations to be made of all suspicious cases and convalescents; three successive examinations were made, and the men were not restored to common barrack-room life until the three examinations proved negative. All the men in the battalion who had had the slightest bowel trouble, ninety in all, were isolated and bacterioscopically examined between February 2nd and beginning of March, a wise precaution, justified by the cessation of any fresh cases after the first infection. The scientific commission declared that: (1) the bacterioscopic examination defined the nature of the disease; (2) the systematic examinations enabled precautions to be taken against transmission of the germ by convalescents or clinically suspicious cases; (3) the preventive measures adopted, isolation and disinfection, stopped the spread of the epidemic. The rigorous bacterioscopic examination of stools, and the retention of the patients in hospital so long as the specific bacillus can be detected in them, are insisted on as essential preventive measures: urotropine is considered most efficacious as a bactericide for the urine.

It is recognised that the work rendered necessary on the part of the army medical service in order to achieve such results is enormous. At Treves, for instance, two months were taken up in preparing for the manœuvres of the 8th Corps, by searching for cases of typhoid fever and other infectious diseases in the district where these operations were to take place. It was indeed a task well worth doing. But work of this kind cannot be undertaken except after long study and laboratory experience, therefore it is

necessary that medical officers should be specially selected and trained for these highly specialised investigations, in order that they may possess the necessary knowledge as well as enjoy the equally necessary scientific prestige.

II.—The Spread of Enteric Fever by Direct Contagion.

The opinion of Murchison, quoted at the beginning of this paper (p. 587), that enteric fever is not, strictly speaking, contagious, was not only the outcome of his own large experience, but represented the preponderant, one might almost say the universal, opinion of the medical profession at that time. And that this was based upon observed facts, we have not the slightest reason for doubting. When Murchison wrote that it was "universally admitted to be a very rare occurrence for the nurses or medical attendants of hospitals to contract enteric fever from the sick under their care," we are justified in believing that such was the case. Bacteriological diagnosis was, of course, non-existent, and it is conceivable that mild, unrecognised cases might have occurred amongst nurses; but such a supposition must not be pressed too far. Physicians were as keen observers in the middle of the nineteenth century as they are now at the beginning of the twentieth, though not in possession of so many aids to diagnosis; it is not probable that, if any considerable number of cases of feverishness with slight bowel trouble had occurred amongst the attendants, such cases would have been overlooked; and it is still less probable that among such supposed contact cases there would have been an absence, or almost an absence, of serious and even fatal cases, which could not fail to be diagnosed and recorded.

For this is not a matter of one man's experience, or the state of things at one hospital, or in one city, or in one country. Again quoting Murchison (*op. cit.*, p. 461), "Dr. Wilks informs me that he has never known a nurse in Guy's Hospital contract enteric fever." In 1856 Dr. Peacock remarked that he had never known enteric fever communicated to the nurses or attendants at St. Thomas's Hospital; while the only instances of enteric fever contracted in all the general hospitals of London which Messrs. Bristowe and Holmes could discover in their official inquiry[1] in 1863, were those of two nurses in the Royal Free Hospital. After five years' experience in the City of Glasgow Fever Hospital, Dr.

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[1] *Sixth Report* of Medical Officer to Privy Council, p. 539.

J. B. Russell thus writes: "As an interesting contrast with our experience of typhus, I may say that no case of enteric fever has ever arisen either among the staff, or among the patients beside whom cases of enteric fever are treated. During twenty-three years (1848-1870), 5,988 cases of enteric fever were admitted into the London Fever Hospital, but only seventeen residents in the hospital contracted the disease, and most of them had no personal communication with patients sick of enteric fever. Of the seventeen cases nine were nurses, only four of whom were employed in the enteric wards, one was a laundress, one a medical officer, and six servants in a building detached from all fever wards. Twelve of the seventeen cases occurred subsequently to 1864, when various extensions of the hospital buildings led to a serious derangement of the drainage, and on more than one occasion the occurrence of several cases in succession in the hospital was found to coincide with the smallest number of patients in the wards and with defects of drainage, the removal of which at once arrested any further spread of the disease. During the same period of twenty-three years, twelve patients admitted with other diseases contracted enteric fever in the hospital. . . . Since 1861. . . . the typhus, relapsing, and scarlatina patients have been kept in distinct wards, whereas the patients suffering from enteric fever have been treated in the same wards with the many patients sent to the hospital who have not been the subjects of any form of contagious fever. The two classes of patients have remained together both during the acute stage of their maladies and in convalescence, in most instances for several weeks. The same night-chairs have been used by both classes, and the employment of disinfectants has been exceptional. The result has been this. During nine years, 3,555 cases of enteric fever have been treated along with 5,144 patients not suffering from any specific fever; not one of the latter has contracted fever."

The subsequent experience at this hospital, as related by Dr. W. Cayley, was to the same effect; from 1871 to 1882 there were 1,795 enteric cases, treated in the samewards as 928 other cases, not one of whom became infected, though a few cases originated in scarlet fever patients in other parts of the hospital. During the same period seven nurses and a ward servant developed enteric, four being taken ill at about the same time; the drain of the ward where they were on duty was found to be obstructed.

In regard to provincial hospitals the only instances that Bristowe and Holmes could discover (1863) were some few cases at

Canterbury (no details supplied), and four cases following on the admission of a typical case at the Bath Hospital in 1862; but these latter cases were afterwards practically proved to have been due to the blocking of a w.c. pan.

In 1880 Dr. W. Cayley delivered his Croonian Lectures on Typhoid Fever. He maintained the same position as Murchison: "It may, I think, be laid down as absolutely certain that an epidemic of typhoid is never caused by the disease spreading by direct contagion, as epidemics of small-pox, scarlatina and typhus are." He had seen many instances of *supposed* direct contagion, but had generally succeeded in tracing them to an indirect source. Thus, during 1879, sixty cases had been admitted to Middlesex Hospital; six nurses contracted the disease, but five of these were engaged in the surgical wards and did not come into contact with the enteric cases.

In 1879 and 1880 Dr. Alexander Collie contributed some articles to the *British Medical Journal*, vigorously assailing the existing orthodox position, as stated by Dr. Cayley. He showed that, since the opening of the Homerton Fever Hospital in 1871, there had been twenty cases of enteric fever amongst the staff, sixteen of which had occurred in persons actually on duty in the enteric wards, and one other in the laundry, employed in washing soiled linen from those wards. Ten of the cases were attacked between twenty-three and fifty days of their coming on duty. There were no drain defects, and no contamination of the water supply. Dr. Collie considered that the cases were due to direct infection, and that the immunity of the nursing staff generally at the London Fever Hospital and in the large general hospitals in former years, was to be accounted for probably by their age; the employment of young nurses (between twenty and twenty-five years), as at Homerton, being of recent institution.

About the same time (1879) Dr. W. Thomson, of Peterborough, recorded in the *British Medical Journal* some outbreaks only to be explained on the hypothesis of direct contagion. In particular, one crucial instance may be mentioned: a young lady attending school fell ill of the disease; she was visited by her mother from a distance, who only stayed with her for half-an-hour, neither ate nor drank anything in the sick room, and washed her hands on leaving. The mother returned home, and in ten days fell ill with enteric. There were no cases in the neighbourhood.

In April, 1900, Dr. E. W. Goodall read a most valuable paper on this subject of the Infectivity of Enteric Fever at the Epidemio-

logical Society.[1] He adduced several instances of localised spread of infection, apparently due to direct contact: three groups of cases numbering four, seven and six, reported by Dr. J. Priestley; a group of five cases, reported by Dr. Fraser Bryett; a group of ten cases, reported by Dr. Boobbyer; all these occurred in the years 1898-1899. Dr. Alfred Hill considered that in the year 1898, in Birmingham, there had been at least eighty-six cases (or one-seventh of the total number) directly due to infection from another case. Dr. John Robertson also wrote that, after investigating nearly two thousand cases, he concluded that about ten per cent. were probably due to direct infection. But the most important facts were those brought forward by Dr. Goodall himself, derived from the experience of the Metropolitan Asylums Board's Fever Hospitals. During the eight years 1892—1899 there had occurred one hundred cases of enteric fever amongst the staff of these hospitals. The total number of cases treated in the period was 5,913. Four of the hospitals, North Eastern, Fountain, Northern and Gore Farm, had never taken in enteric cases, unless by accident or very exceptionally; no cases had occurred amongst the staffs of these four hospitals (save two at the North-Eastern). With regard to the Eastern Hospital, where twenty-nine cases had occurred amongst the staff, Dr. Goodall stated that eighteen (at least) had been employed in the enteric wards when they contracted the disease. Of ten cases at the Brook Hospital, five were nurses in the enteric wards and two were men whose duty it was to keep the floors of these wards polished. Three cases at the Grove, the then most recently erected hospital, had all been working in the enteric wards. Dr. Caiger stated that at the South-Western Fever Hospital, twenty-three of the staff had contracted enteric fever, every one of them a nurse, and all (except one) nursing in the enteric wards. Dr. Bulstrode quoted Dr. Niven, of Manchester, who had stated that in the year 1898, fifty-three out of 484 cases in that city could be traced to direct infection; and that if to these were added cases occurring in public institutions, about one-seventh would be found to be so accounted for. This agrees with Dr. Hill's opinion mentioned above.

In 1898 an outbreak occurred in the Bron Asylum for the Insane, near Lyons (*Public Health*, vol. xiii., 1900). There were thirty-five cases, mostly amongst the female patients and attend-

[1] *Transactions*, vol. xix.

ants; infection by water, food, and drainage defects could be excluded. Professor Bard considered that the propagation was due to direct infection, connected with want of care in dealing with the fæcal discharges of the sick.

During the Spanish-American War of 1898, when the United States troops were assembled in vast camps at selected sites in Virginia, Florida, Georgia and Pennsylvania, it is reported that within the five months May to September, no fewer than 20,738 officers and men (nearly one fifth of the force), were infected with typhoid fever, of whom 1,580 died. This epidemic was inquired into by a Board of Medical Officers (Reed, Vaughan, and Shakespeare) and an abstract of their report was published in 1900, the principal points of which have been summarised by Dr. Christopher Childs in the *British Medical Journal* (July 26th, 1902). All the circumstances were carefully investigated, infected water was excluded; a minute investigation was made into 1,608 individual cases with a thoroughness only to be compared with that characterising the German Scientific Commission of the following year, that has been already alluded to. The following important conclusion was arrived at: "Typhoid fever, as it developed in the regimental organisations, was characterised by a series of company epidemics, each one having more or less perfectly its own individual characteristics. . . . Men in the same company came down with the disease on the same day. This is still more marked when we study the cases with reference to the tents occupied by the men. In 1,608 cases of typhoid fever which we have been able to accurately locate in the particular tents in which they occurred, together with the date of the commencement of the attack, the results may be summarised as follows:—

Directly connectable attacks (in same tent) ...	563, or 35·01 per cent.
Indirectly connectable attacks (in next tent) ...	447, or 27·79 ,,
Total connectable attacks	1,011, or 62·8 ,,

Certain tents were badly infected, and the majority of their inmates developed the disease, while other tents wholly escaped." As Dr. Childs says, "the evidence adduced is sufficient to make a very strong case for the verdict of the Commission that the direct and indirect infection in tents were most important factors in the spread of the epidemics."

In 1900 a camp was formed for the reception of Boer prisoners of war at Diyatalawa, Ceylon. Some 5,000 men were accommo-

dated here on an absolutely clean and healthy site, with a water supply above suspicion. Enteric fever was introduced into the Camp in September, and between September 22nd and November 29th there were 711 admissions for this disease. Sir Allan Perry,[1] Principal Civil Medical Officer, considered that dissemination might have occurred through infection of the latrines, or by flies; and noted the circumstance that "the habits of the Boers at first were far from sanitary. After defæcation it was usual not to use any means of cleansing the person; in this way the inside of the trousers became fouled, and the dried excrement may have been disseminated in the huts (although it should be remarked that the clothing of many men was examined bacteriologically, but no true *B. typhosus* was found)." Careful disinfection and segregation rapidly brought the epidemic to an end, though not before twenty-four soldiers of the military guard had been attacked, doubtless through aërial (though hardly direct) infection.

There is a very widespread impression amongst Army Medical Officers that, during the South African War, in very many cases propagation of enteric fever took place by air-borne infection (dust, flies, &c.), and more especially by soil or dust-infection in particular tents, but no exact information on this subject is available up to the present.

A very striking example was recorded by Dr. Horton Smith, in 1903 (*Lancet*, April 11th), in a series of nine cases. The first case, at Haggerston, a girl aged 15, was not recognised, and no precautions were taken; she died October 15th. (2) Her sister, who had slept with her during part of her illness, sickened on October 16th. (3) Her mother sickened about the same time. (4) Her brother on October 19th. (5) Her aunt stayed at the same house during the first week in October, was out of sorts the next week, and gave a positive Widal reaction (1 in 30 in ten minutes) on November 6th. (6) Her father sickened on November 2nd. (7) Another brother left the house on October 20th, went to Croydon, was slightly ailing on the 23rd, and on November 21st gave "fairly complete agglutination," 1 in 20, "slight" 1 in 50; probably an exceedingly mild case infecting the next two. (8) A boy living in same house as No. 7, sickened November 12th. (9) An infant sister of No. 1 left the house on October 28th for Croydon, was suddenly taken ill on November 17th with shivering, vomiting, diarrhœa and fever,

[1] *British Medical Journal*, March 15th, 1902.

afterwards bronchitis; no characteristic symptoms and Widal reaction negative until 28th, when it was positive, 1 in 30 in ten minutes; death on December 10th, but no *post mortem* allowed. No enteric fever was prevalent either at Haggerston or at Croydon. The diagnosis seems to be clear, and the only probable cause of the cases after the first was direct contagion.[1]

(*To be continued*).

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[1] See also a paper by Dr. Herbert Peck, on the Frequency of Sick-room Infection in Typhoid Fever (*British Medical Journal*, September 2nd, 1899). Twenty-eight cases are related.

SURGERY OF A PUNJAB TOUR.

By Lieutenant-Colonel H. A. HAINES.
Royal Army Medical Corps.

The following notes are taken from a brief record of major operations of my last four years in the Punjab. They occurred chiefly in Cantonment Hospitals and in Zenana Mission Hospitals, in which the surgical equipment would be quite a shock to the Advisory Board if it ever inspected them; on the other hand, the nursing in the Zenana Hospitals was exceptionally good for India.

Amputations were eleven in number, and nearly all different; the largest at the middle of the thigh in a man aged 40. One of the upper arms was notable as an example of the Hakim's idea of surgery. A girl aged 17 had fallen from the roof of her house and sustained a compound fracture of both bones of the right forearm; the "treatment" had been simply a very tight bandage from hand to upper arm, no splint; the natural result was gangrene of the limb extending half-way up the humerus. After five days the Hakim said that he could do nothing more for his patient, so she came to hospital, and the arm was removed just below the deltoid insertion. Her temperature that evening ran up to 105° F., but was normal next morning, and did not rise again; as there had been no fever previous to the operation, it appeared to be the result of the opening of the Hakim's bandage allowing an inrush of septic products from the gangrenous mass into the general circulation.

Operations on bones were forty-five, the majority being on the long bones, but one young woman had a necrosis at the vertex of the skull, for which there was no apparent cause; a thin plate of bone the size and shape of a shilling was removed, and there was no further trouble. For bone diseases I found that an excess of fresh air was an essential factor in treatment; in those who remained in their own homes in city or village the disease ran on for long periods in spite of diet and tonics, &c., more especially when the patients were Hindus, who, on account of caste laws, are so difficult to prescribe good diets for. As a local application nothing was found so useful as dilute sulphuric acid in gradually increasing strength.

Joints.—Six operations, four of which were formal excisions of elbow, wrist and knee, that of the wrist being the only one unsuccessful. It had been undertaken instead of amputation, as the

patient refused to part with her hand; it, however, came to that in the end.

Club Foot, &c.—Four, all successful, but they were in young and otherwise favourable subjects; splints made by the local carpenter were used in after-treatment.

Piles.—Four, internal and external, all successful. I found it difficult to get Indians to submit to operations for hæmorrhoids.

Hernia.—One case, scrotal congenital, in a boy aged 3.

Plastic and Miscellaneous.—Thirty, including hare lips, imperforate ani, nerve-stretching, resections of painful stump, circumcisions, &c., but not including the minor operation I generally do for soldiers, viz., slitting up the prepuce and cutting two or four sutures. I have never seen the wound become "one large chancre," which it is said may happen, but it is important to have the man for a few days on mercury, to let the part bleed and to dress antiseptically.

Glands removed from tubercular subjects, forty-three chloroform cases. In several, large masses, extending from the jaw to the clavicle, were excised, many healed by first intention, and all did well, except an old woman, who would never allow her sinuses to be dressed thoroughly; the whole of one axilla was diseased, and nearly all of it was got to heal but some deep sinuses to the apex. She, however, lived about two years after the operation in comparative comfort.

Abscesses opened, forty-eight, all large, under chloroform, including "psoas," "lumbar," perimetric, &c., and a few cases of paracentesis of abdomen. I have never seen at home anything like some of these enormous "cold" abscesses in the extremities, without apparent cause, and occurring in otherwise healthy people, generally young. Among a multitude of ulcers treated, one with a curious origin was shown me by Dr. Bose, in her hospital. It was on a small infant's back, just below the inferior angle of the right scapula, and was about 1 inch in diameter. There was a small hole in the centre through which, on the child's crying, air bubbled in and out. A few days previously a foreign body had been seen in the hole, and, on being extracted, was found to be part of the stem of some plant which had been swallowed, and had worked its way out. It was about 2 inches long and $\frac{1}{8}$ inch in diameter; the mother said that the sore had been there for a month. It healed up readily after the extraction of the foreign body.

Tumours.—Forty-three of all varieties, cancer, sarcoma, fibroid, epulis, lipoma, chondroma, &c., including cancer and polypi of the uterus. Many of the uterine cancers were too far advanced when

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seen to do more than curetting as a palliative measure, but the patients were greatly relieved from pain and hæmorrhage by a free scraping, followed by swabbing with pure nitric acid. One cervix was amputated. One case was a curious cyst lying on the outside of the sacrum of a woman aged 35. It was sausage-shaped, 4 inches in diameter and about 9 inches in length. It curled round the end of the coccyx and extended up behind the rectum about 2 inches, being here much less in diameter. The wall was of thick, white connective tissue; it shelled easily out of its bed; the contents was a pale, yellow fluid, with no solid particles in it to suggest a post-rectal dermoid, which it probably was.

Eye Operations.—Ninety, including iridectomies for glaucoma, &c., strabismus, trichiasis, enucleations, abscissions, pterygiums, &c.

Cataractous lenses extracted 113, with a percentage of successes of ninety-three. A percentage of 98 can be and is quite easily obtained by a little selection, but when an old woman and her family sit down for days in front of a tender-hearted missionary and attribute every possible and impossible motive but the right one for refusal to operate, then some cases are undertaken on but a slender chance of success. Latterly Lieutenant-Colonel Mahoney's method of entire extraction was used. When the eye is a "good one" the cosmetic effect is splendid, but I found that if there had been any iritis, peratitis, &c., the results were not so satisfactory. A great advantage is that no instrument but the knife is introduced into the eye, and I have never seen iritis or prolapsi after it. This operator holds that the capsule is not connected with contiguous structures, so that on moderate pressure the lens and its capsule will shell out easily. This was certainly the case in those I did, but more than usual care with regard to loss of vitreous is necessary and a light touch is essential, hence probably the reason that many surgeons object to the method.

Possibly after degeneration and disuse of the lens atrophy of its suspensory ligament sets in, especially in India, as people are blind from cataract for years before they seek relief, and so there is plenty of time for changes in the tissues. The somewhat similar shelling out of the prostate gland in Freyer's operation is suggestive of an analogous condition, as in earlier life either operation would probably be impossible. In only one of the above series did suppuration occur; the patient left the hospital on the fourth day without permission, and returned on the eighth with the eye destroyed. At first I operated on cases in the verandah of my bungalow, if they refused to to go to hospital, but I discontinued this practice when one day I

caught an old man, three minutes after lecturing him, not only sitting up, but rubbing his dirty finger into his eye "because it was itchy!"

Vesical Calculi.—Ten cases treated by litholapaxy, eight of them being in females; nine were successful, and the tenth—a boy—was taken away by his parents on the third day, so the termination was doubtful. The largest stone weighed $4\frac{1}{4}$ ounces, and the crushing of it could not be completed; it lay in a pocket at the back of the bladder, and only a few chips could be broken off, as a good grip could not be got on the stone, and the woman was very old and weak. I cut down on it in the middle line of the vagina and removed it, closing the incision quickly, and using only six sutures $\frac{1}{2}$-inch apart. However, it never leaked a drop, but healed by first intention; a catheter was used every two hours.

In the text-books one is rather airily directed to keep the bladder full of water by means of pressing two fingers up against the urethra, but I have yet to find an assistant who is able to keep the water in and at the same time let me work the instrument.

Midwifery operation cases, seven. In six forceps were employed, and in one podalic version. Three were interesting as being in native women: one Mussulman, one Hindu, and one sweeper, or no caste. These people will generally admit the fact, that in childbirth they prefer their women to die rather than call in a man's aid. Two of these had been in labour for two days each, and the third said that "her water had broken seven days before, and that pains had been bad for three days." She and her husband were full of gratitude, declaring, with truth, that "had I not come, she and her child would have died."

Vesico-vaginal Fistulæ.—Seven operations in four women. The first one required three sittings to close completely the deficiency in the wall, but the patient being determined to be cured, the case was most encouraging. The second woman was operated on twice, reducing the opening from 3 inches to $\frac{1}{4}$ inch, but she would not submit to another operation. In the third case the "fistula" was of a hopeless size, and the woman herself careless. In the fourth, the opening was $1\frac{1}{2}$ inches wide, and it was closed in one sitting; the mucous membrane was denuded from two existing folds of the vagina for about $\frac{1}{2}$ inch on either side of the opening above and below, and the raw surfaces united by fifteen sutures. I found the use of a balloon, as suggested by Maclean, a great help, but instead of putting it into the bladder through the fistula, I dilate the urethra slightly and carry it in by that route with a forceps, thus leaving the

fistulous opening quite free to work on, and the subsequent temporary paralysis of the urethra is an advantage rather than otherwise. These operations were the most arduous performed, as I had none of the special instruments available, but had to work with ordinary scalpels, forceps and suture needles.

Two Exploratory Laparotomies were undertaken, one was a case of a small movable tumour at the free edge of the liver, numerous others being found in the hepatic substance ; nothing further was done. In the second one, a cancer of the fundus uteri was found to have spread to adjacent parts, though free and movable a few days previously.

Panhysterectomy by the abdominal route was performed in a case of cancer, but loss of blood before consent to an operation had been given was too much for the patient, and she only lived one day afterwards.

Cæsarean Sections.—Three, two of which ended fatally ; one from clot in the heart two days after operation. She had been going on capitally, asking for food, wanting to sit up, &c. The second died from exhaustion twenty-six hours after, she had been three days in labour without asking for relief, the outlet of the pelvis admitted only one finger ; she also had no abdominal symptoms, neither pain, tension, or vomiting, &c. In the three operations the pressure of a nurse's hands on the uterus was found sufficient to control hæmorrhage without the use of Müller's rubber tube. In none of the cases was the uterus taken out of the abdomen, it was sutured easily *in situ*. Two of the children were dead, and the third very lively.

Extrauterine Gestation. — An operation was performed in a woman who had gone four months over her time. Unfortunately, numerous adhesions to the intestine were found, the hair of the fœtal head had grown straight out like the bristles of a brush, and had penetrated the sac and the wall of the cæcum. The fœtus had died at about the eighth month. A drainage tube was left in, and the patient went on well as far as abdominal symptoms were concerned, but cardiac weakness was very marked, and increased steadily, in spite of strychnine, &c., and on the fourth day the patient succumbed to it.

One Ovarian Cyst was tapped, and twenty-five pints of fluid removed. The patient would not allow a more serious undertaking.

An Abdominal Tumour in a girl, aged 16, was a very interesting case for diagnosis. She said she had noticed the tumour first ten months previously, and that, as she had been recently married, she and her

friends thought it was pregnancy. After six months' gradual and painless increase, the tumour presented at the vulva, and for the last week it had caused complete obstruction of the bowels and retention of urine. This state and great pain had caused her to come to hospital for relief. On examination a tumour was found filling the abdomen, tense and quite devoid of fluctuation, dull all over except at the flanks, and immobile; no enlarged veins, and no sounds on auscultation. The tumour, glistening at the sides, red and black in the centre, bulged out of the vulva, beginning to ulcerate, and dimpling very slightly on pressure. A catheter was with difficulty passed, going in four inches, and an ounce of clear urine drawn off. Nothing could be passed into the vagina beyond the tumour. Its appearance was very suggestive of sarcoma, but before committing myself to a diagnosis, I decided to cut into the visible portion. On doing so a thick treacle-like fluid oozed out, which at once gave the name for the condition. About two pints of menses came away, and a catheter was then easily passed, relieving a greatly distended bladder. This was the second case in which absence of fluctuation in a distended bladder had deceived me. The first time was in a woman also, whom a *confrère* had sent in, as an "abdominal tumour for further examination." From external examinations I could make nothing of it but a solid movable tumour, probably of the uterus, but fortunately I insisted on a catheter being used in my presence, though an assistant said that this had been done several times in the last few days. Over three pints of healthy urine were now drawn off, and simultaneously our "tumour" disappeared.

Of some aspirations of liver one case died suddenly the next day, cause was not discovered, a *post mortem* being objected to (as usually in India). This made a total of five deaths in 457 cases.

May I hope that these notes will draw the attention of my brother officers to a fine field for operating surgery when they are in India. I think all the mission hospitals are glad of occasional help and would welcome assistance, and certainly the opportunities to be got in them are seldom likely to be seen in our Station Hospitals.

EPIDEMIOLOGY—AN INTERESTING QUEST.

By Major CATHCART GARNER.
Royal Army Medical Corps.

On September 8th, 1904, the Department was notified of the appearance of plague, probably pneumonic, in the village of Seyaffa, in Qualioobia Province, Egypt. The notification was made by the Native District Sanitary Inspector, who reported that the normal monthly mortality had already been exceeded. The report was received at headquarters with some disappointment, because the experience of the last six years had led us to look for a diminution if not a disappearance of plague in the districts, between the months of September and March ; the reason probably being that rats usually litter in Egypt in the early part of the month of March, and the new litters presenting no immunity, readily become infected with plague in places inaccessible to, or which may have escaped the vigilance of, our disinfecting gangs. By October these litters have either died or become immune. In this case, however, there was a probability that the infection had been spread directly in the pneumonic form from man to man, because the last cases of plague which had occurred prior to the receipt of the report had been a series of seven in a village only five kilometres' distance from Seyaffa, three of which cases had occurred in one family, and had been of pneumonic type, so it was not unreasonable to suppose that a friend or relative of this family infected with pneumonic plague had fled to Seyaffa, and had infected the community there.

On receipt of the report the usual precautions were taken ; a special native doctor was sent to reside in the village, also a trained disinfector in charge of a disinfecting gang ; a hospital was pitched, a house to house inspection for sick and contacts was made, and a regular disinfection of the infected houses and their contents was carried out ; cultures from lungs and spleens of deceased cases were to be taken by sterilised syringe, sowed on agar-agar tubes, and forwarded to the Hygienic Institute for bacteriological examination. An English sub-inspector was ordered to visit the place several times weekly and report.

The result of all this was that seven cases were found and removed to hospital, all of whom with one exception died within twenty-four hours. Dr. Ekins, the English sub-inspector in charge, reported certain peculiarities of symptoms which did not tally with

our experience of plague, and, moreover, drew attention to the curious fact that all the cases which had been seen, and all the deaths which had occurred in the village up to September 12th, had been those of women over thirty years of age, that no two cases had occurred in any one house, nor had any two contiguous houses furnished cases.

The first cultures arriving at the laboratory were negative as regards plague bacillus. The diagnosis of plague was therefore more than doubtful; on visiting the village I found fifteen people segregated, six cases in hospital, nine in isolation tents. The cases in hospital were all women of over middle age, the contacts were in good health, and after five days' supervision were allowed to return to their houses. No co-relation could be found among the cases, they had come from houses dotted all over the village, as before noted by Dr. Ekins; the majority of the deaths had ensued within thirty hours of the first attack; further, it was found that the village which we suspected as having infected Seyaffa, was separated therefrom by one of the largest water-ways in Egypt, the Rayah Tewfiquia, and that there was no relationship by marriage or otherwise between the two villages, and little or no communication in the ordinary way. The orders with regard to isolation, disinfection, &c., had been carefully complied with and carried out.

The Omdeh, or head-man of the village, was a reliable man, who had already been promoted for good work done in connection with Public Health Administration, and I had every reason to believe that his reports and statements concerning the families, houses and relationships in Seyaffa and the neighbouring villages were correct. No trace of any infectious disease or unusual mortality was found in any of the villages within a radius of fifteen miles, and all deaths occurring in such villages were inspected by qualified medical men, instead of by the village barber-surgeons, as is usually done in places where no qualified sanitary medical officer resides.

On examining the cases in hospital carefully I was convinced that we were not dealing with plague: symptoms, history of cases, ages, were all against such diagnosis. The symptoms briefly were as follows: Sudden attack with intense feeling of chilliness and rigor, splitting headache, increased rapidity of breathing, cyanosis of face and extremities, thready rapid pulse; physical signs in lungs, although apical, suggested bronchitis rather than pneumonia, dulness at base due to pleural fluid in some cases, no diarrhœa, vomiting not a marked symptom and absent in most of the cases, no buboes. All the cases were women over thirty-five years of age. Nearly all

the deaths had occurred within thirty-six hours of attack, and in one case, which had been under observation from the very first feeling of malaise, the woman had died in seven hours. One symptom present in all the cases was a feeling of intense pain and oppression as of a crushing weight over the sternum, so agonising as to cause patients to scream.[1] The patients, instead of presenting the stupid "abbattu" appearance of plague patients, were observant, asking if they had a chance of recovery, &c., and in some cases remained conscious up to the moment of death.

Reports from the Hygienic Institute still showed that the cultures gave negative results as regards plague bacillus. Excluding the diagnosis of plague, the outbreak became an exceedingly interesting one, and every effort was made to fix the diagnosis. The closest supervision was now established over the village, one of our English staff visited daily; and another native doctor, specially chosen on account of his ability and intelligence, Dr. Aly Eff. Ibrahim, was sent down to co-operate with his Egyptian colleague, and to trace carefully any clue that might be found. Owing to the horror and dislike of autopsies amongst natives, and to the attendant dangers thereof in dealing with pneumonic plague, no *post-mortem* examinations had been allowed. Now, however, Dr. Aly Ibrahim was instructed to make one or two autopsies, in the event of any further deaths occurring.

On September 15th, up to which date ten deaths had occurred (always amongst women of middle age) since September 9th, a woman aged 40 was found suffering from a malignant pustule on the left cheek.

On September 17th a man who had probably fled from the village to escape the previous house to house inspections, returned to his house by night and died there; he had a large anthrax (Charbon) on the back of his neck; while the doctor was examining the corpse he became aware that there was more than the usual excitement afoot amongst the women of the house, and on examining them he found one of them at the point of death, so ill indeed that he could not remove her to hospital. She died almost immediately, and the culture which was taken from her lungs was sent to Cairo for examination; it was found to contain over a hundred colonies of pure anthrax bacilli, and guinea-pigs inoculated with it died forty hours afterwards from true anthrax.

[1] It is very unusual to find the phlegmatic fellaheen giving expression to any pain.

An autopsy was made by Dr. Aly Ibrahim, who reported a normal condition of the viscera with the exception of the heart and lungs. Under the heading "Heart" he reported: "Pericardium normal, its cavity contained about five tablespoonfuls of clear serum, the heart muscle was covered with a large amount of fat but the muscle itself was apparently normal but soft, the cavities contained a moderate amount of dark bluish blood. The valves were normal." Lungs: "Both lungs had the same appearance. The pleural cavity contained about 300 cc. of yellowish clear serum. The surface of the lung was œdematous and covered with a gelatinous clear substance not unlike coagulated serum. The lung itself was normal in colour and consistency except for a few scattered patches which felt solid, and of the size of a millieme (sixpence); the lung was not congested and its cut surface was apparently normal, except where one of these little solid patches had been cut into, when it looked dark red in colour or resembling liver. When squeezed it oozed frothy mucus and serum in abundance, but was unstained with blood. Larynx and trachea inflamed in places. Bronchial glands enlarged." Professor Eppinger, in his paper "*Die Hadernkrankheit*," published at Jena, 1894, describes the pleural and pulmonary *post-mortem* conditions in almost identical terms.

Cultures taken from cases which died on September 17th, 18th, 20th, 22nd and 23rd, all contained anthrax bacilli unmistakable in their macroscopic and microscopic appearances, their mode of growth, and their morphological action and effect upon guinea pigs. There was consequently no longer any doubt whatever as to the diagnosis. We were dealing with a serious outbreak of anthrax (wool-sorters' disease) in the pulmonary form. Having arrived at the diagnosis it remained to determine the cause and mode of infection. One fact stood out clearly, that (with the exception of the man who had died of the Charbon) all the cases had occurred and were occurring among women aged 35 to 40, and upwards.

Restrictions had been generally imposed throughout Egypt, on account of rinderpest, on the skin and hide trade, consequently no hides, bones, &c., were found in the village, and as the result of the disinfection, which had been carried out on the assumption that we had been dealing with plague, all shreds of wool, rags and other rubbish had been burned. Owing to the shortage of meat in the country due to the severe visitation of cattle plague in 1903, the embargo which had hitherto being placed on the importation of cattle and sheep from Syria had been conditionally

removed, *i.e.*, they were allowed to come into Egypt after undergoing a short period of quarantine and observation. Anthrax is not uncommon amongst the sheep in Syria, so it was considered possible that in spite of the quarantine and observation imposed, some infected sheep might have reached the village. After a most careful search, however, no trace of disease was found amongst the cattle or sheep either in the village or within a radius of twenty miles of it. Still, the fact of not finding a case of anthrax amongst the cattle or sheep existing did not negative the possibility of such cases having occurred some time before.

We proceeded to follow the clue that only women of a certain age had suffered. With the exception of the professional water drawers (Saqqaeen), only women fetch the water for home consumption; it was possible that a back water or well might have become contaminated by an anthrax infected carcase; watchmen were accordingly posted to prevent women drawing water from other than known pure sources. It was soon seen that this theory was untenable, because: (1) Cases continued to crop up after the water supply had been guarded; (2) the cases continued to take the pulmonary and not the intestinal form; (3) if the water brought to the houses were infected, not only the old women but also the men and children would have contracted the disease.

Rags, shreds of wool, and wool-spinning had been constantly kept in view as possible means of infection; but the village had been disinfected and re-disinfected by our gangs under a highly trained superintendent, I had personally assured myself of the removal and destruction of all rags, bones, hides and rubbish; and as regards the wool, little or no spinning is done by women in Egypt, such work is almost invariably performed by the men, among whom not a single case had occurred. Consequently we were forced to discard the supposition that rags, wool, &c., were a source of infection in this case.

On September 30th, while returning to Seyaffa from a tour of inspection of the neighbourhood in company with an English Sub-Inspector and a Sheikh of the village, we happened upon a dead donkey which was remarkable only in that it had been a valuable beast, worth £20 at least, and that it had evidently died suddenly, because it was in magnificent condition and could not have been ill for more than a day or two prior to death. On remarking to the Sheikh on the loss such a fine beast must have been to its owner, he replied that there seemed to be some bad luck on the village, as not only were the women dying, but within the last

fortnight eight or nine donkeys also had perished. This was interesting, and naturally arrested one's attention.

It must be remembered that in spite of our enquiries concerning disease amongst sheep and cattle no one in the village had breathed a word about any mortality amongst the donkeys. I confess that I had never entertained the possibility of donkeys becoming infected with anthrax; now, however, that this information with regard to a donkey mortality had been volunteered it appeared worth while to enquire into it. Dr. Aly Ibrahim was accordingly told to ferret out all he could concerning the statement, and was instructed, in the event of any further deaths occurring amongst the donkeys of the village, to send up cultures to Cairo and to make a *post-mortem* examination.

On October 2nd another donkey died at Seyaffa, and the culture taken from the lungs and sent to Cairo disclosed many colonies of anthrax bacilli; moreover, not only the lungs but also the trachea displayed similar pathological lesions to those found in human cases and described by Dr. Aly Ibrahim and Professor Eppinger. The statement that several donkeys had died within the last month was also corroborated by the Omdeh and Sheikhs in the course of conversation with Aly Ibrahim. Attention was next turned to the number of donkeys that had died; it was found that up to October 4th fifteen donkeys had certainly succumbed, probably more, but no clear history could be elicited beyond these fifteen; it was then demonstrated that in most of the houses where donkeys had died, human cases had also occurred, and any cases which had not actually come from the same houses as dead donkeys had been found in houses close by.

Endeavouring to find the manner by which a donkey could become infected with anthrax in the pulmonary form, we could safely exclude food; it seemed impossible that any corn, beans or chopped straw could convey the infection, and as regards grass (Barseem), if it had been contaminated by anthrax-infected cattle or sheep we should have found donkeys attacked by the intestinal rather than by the pulmonary form of the disease. A donkey in comparison with a horse, mule, horned cattle or sheep is a clean feeder, but it may be noticed that he usually muzzles or sniffs at any droppings, dung, or urine which he encounters. If sheep or cattle infected with anthrax in the usual form had been in the village it was certain that their dung would contain anthrax spores; as I have mentioned, we had already made close enquiry as to any mortality amongst the village sheep and cattle, with a negative

result; but on thinking the matter over it was remembered that although cattle plague (rinderpest) had broken out among the cattle of Seyaffa in the autumn of 1903 and had been successfully stamped out, a second invasion occurred in January, 1904, which, though of mild type, had lasted for some months, and had accounted for thirty-five deaths amongst the village cattle. Was it not possible that, the attention of our veterinary staff having been concentrated on rinderpest, some cases of anthrax might have occurred and escaped recognition. Enquiries were accordingly set on foot again, and it was found that many of the deaths amongst the cattle which have been returned as rinderpest during the outbreak in spring, did actually come from the very houses which had furnished us with either human or donkey cases of anthrax, or both. The Omdeh and Sheikhs of Seyaffa also admitted that sheep belonging to the village had died, but as they did not suppose they had died from cattle plague no report had been made. Although it is true that sheep may be attacked by cattle plague, still the disease takes such a mild course in these animals that recovery is the rule, and I can find no authenticated cases in Egypt or elsewhere of sheep dying of rinderpest. Professor Koch's experiments in South Africa also tally with our Egyptian experience in this respect. Consequently the suspicion that cases of anthrax had existed amongst the cattle and sheep at Seyaffa so early as the months of January, February, March, and April became almost a certainty, but required proof.

The fellah as a rule stables his sheep, cow, camel, goat or any live stock which he may possess in his house, or at best in a small covered zariba or byre immediately off the living rooms of the house. The dung from these animals, supposing one or more were infected by anthrax, would naturally contain bacilli and spores. It is collected by the children and is used for two purposes: (*a*) For manure; (*b*) for the making of "gilla," a mixture of dung and chopped straw formed into round flat cakes or hollow oblong bricks and allowed to dry, when, as occasion requires, it is used for firing.

The dung of the cattle deceased during the outbreak in the spring had of course long since been removed, but the gilla remained, and owing to the known resisting power of anthrax spores we still expected to find spores in the gilla, if the dung from which it had originally been made had been infected. Professor Bitter, the Director of the Hygienic Institute, kindly undertook the task of finding anthrax spores if such existed in the gilla, remarking at the same time that the gilla might prove after all to be the real source

of the anthrax outbreak in the village. On reflection, it seemed that the proof of the existence of anthrax spores in the gilla would clear up any doubt and dissipate all the difficulties which had met us in tracing the source of the outbreak. The one household duty

FIG. 1.—Examples of round and long brick Gilla.

FIG. 2.—Method of stacking Gilla bricks on house tops at Seyaffa.

almost invariably performed by middle-aged or old women amongst the fellaheen is baking (very exceptionally infirm old men confined to the house help in this work). The baking is done either in a mud oven or on a large round flat iron over an open fire, but in

either case the fire is made of dried gilla; so that a woman in breaking gilla cakes before placing them on the fire or in the oven would almost certainly inspire some of the resulting dust. Personally I felt so convinced that this was the real mode of infection, that on October 4th I went down to the village and asked the Omdeh and Sheikhs to apprise the whole village by crier of the danger from the gilla, advising the employment of other firing where available, and if none other were available, that the women should cover their mouth and nose with their veils when handling or breaking gilla, or when baking.

Specimens of the dung from donkeys from the village had already been examined, but as was expected no trace of anthrax was found, the donkeys being infected only by the pulmonary form of the disease. Samples of gilla from the different houses where either human or donkey cases, or both, had occurred were now collected and sent up to Professor Bitter, who on October 10th proceeded to inoculate a series of guinea-pigs directly with it.

It was found that the inhabitants of Seyaffa only used the round gilla made in the spring time for fuel during the summer months; the oblong brick-shaped variety which is made in the winter months is stored on the roof tops and is kept for long periods, sometimes three or four years, being used as required during the late autumn, winter, and early spring; consequently the search for anthrax was confined chiefly to the round-shaped gilla as being that most likely to have become infected during the months of February, March, and April.

Professor Bitter's experiments were naturally followed with great interest, because if the guinea-pigs succumbed to anthrax the chain of evidence as to the source of infection of both old women and donkeys would be complete. Nevertheless we were convinced that even if the experiments proved negative the gilla was the true source of infection, because from the day following the exhortation of the Omdeh and Sheikhs that the women should veil themselves while baking, or desist altogether from using gilla as firing (*i.e.*, October 5th), no further case had occurred in the village, whereas prior to this one or two cases had been occurring daily.[1]

On October 13th Professor Bitter reported that one of the

[1] This cessation of cases continued until July 12th, when, probably the effect of the Sheikhs' warning having passed off, some of the women failed to take the precautions advised.

guinea-pigs inoculated with gilla taken from houses at Seyaffa which had furnished a case of anthrax in a woman, and in which a donkey had previously died, had succumbed to true anthrax; this was good news and confirmed our belief. Orders were at once sent to Seyaffa to destroy by fire all the round gilla which existed in the village. This was done under the supervision of an English inspector, and the people were compensated in money. Professor Bitter, to make assurance doubly sure, made some further inocula-

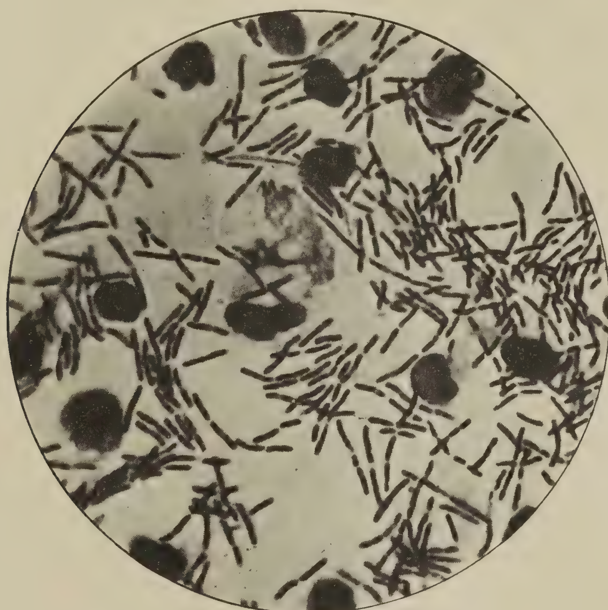

FIG. 3.

tions from gilla taken from other houses suspected of harbouring anthrax infection, again with a positive result. The accompanying microphotograph of typical anthrax was taken from a preparation from a guinea-pig which was inoculated on October 20th, and died four days afterwards. From the date of the destruction of the round gilla in the village no further case of anthrax occurred; the epidemic was completely stamped out.

Remarks.—To summarise, a small outbreak of anthrax had occurred amongst cattle and sheep at the time when attention was centred on rinderpest, and the cases of anthrax having escaped notice had been returned as cattle plague. The droppings of these

animals infected with anthrax had been collected and made into gilla, which consequently infected both women and donkeys. The mode of infection in both had been similar, by inhalation: the donkey snuffing at the gilla heap, the woman by inspiring gilla dust when baking.

Thirty-eight human cases occurred altogether, two of which had taken the form of malignant pustule and one had been of the intestinal form. Only two men were infected: one was the man who died of Charbon on the back of the neck, the other an old man, a Fikki,[1] who never left the house and assisted his wife to do the baking. All the cases with one exception had been amongst people of middle age or more; the exception was the intestinal case which occurred in the person of a young girl, *i.e.*, a child who had been employed in the stacking of gilla in heaps, and who had therefore probably infected herself directly from her hands. The period of incubation appears to be without doubt a very short one, probably within twenty-four hours, as shown by the fact that after the order was issued on the afternoon of October 4th that women should veil themselves before baking, no cases occurred between the 5th and the 12th, when two men were attacked, probably because they neglected to take the precaution advised. After October 15th, by which time all the round gilla had been incinerated, there was a complete cessation of the epidemic.

A point of interest to be noted is that one may easily miss finding anthrax in the lung by aspiration if the point of the needle does not happen to enter one of the foci of infection. Consequently several aspirations should be made and several tubes of agar-agar should be sowed. I am unable at present to state whether the pleuritic exudation invariably contains anthrax bacilli or not, probably it does. I trust Professor Bitter will publish some remarks on this point and others in connection with this rare disease; my best thanks are due to him and to Dr. Aly Ibrahim for the valuable aid they afforded in tracing the infection step by step.

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[1] A reciter of verses of the Koran.

REPORT ON A CASE OF EXPERIMENTAL SLEEPING SICKNESS IN A MONKEY (*MACACUS RHESUS*).

By Captain D. HARVEY.
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Since 1903, when Colonel Bruce first demonstrated that the causal agent of sleeping sickness was a trypanosoma, more and more evidence has been forthcoming to confirm the truth of this observation, but up to the present one link in the chain of evidence has been missing, namely, a convincing animal experiment.

Mott,[1] in 1900, in describing the pathological changes in the brain and cord of three cases of sleeping sickness drew attention to the presence in all three cases of a perivascular infiltration, this infiltration consisting principally of large and small lymphocytes, and some large mononucleated granular cells; since 1903, he[2] has examined the brains of twenty-six cases of sleeping sickness, and in all has found the same lesion. So it may be taken that unless this condition is present we are not dealing with a true case of sleeping sickness; indeed, the cardinal symptom which gives its name to the disease is in all probability due to an anæmia of the brain matter caused by the pressure of this accumulation of lymphocytes occluding the smaller vessels.

So far no animals, experimentally inoculated, either with blood or cerebrospinal fluid from cases of sleeping sickness, have shown this particular and essential lesion. Prior to Colonel Bruce's arrival in Uganda, the Portuguese Commission and Dr. Castellani[3] had found a coccus, usually a diplococcus, in the cerebrospinal fluid of a large proportion of cases, 80 per cent., and were inclined to attribute the disease to this organism. Dr. Castellani, by centrifuging the cerebrospinal fluid, demonstrated the presence therein of a trypanosoma, but, as he was aware that trypanosomata were to be found in the blood of a large number of the natives of the district, he did not connect this parasite with the disease, and placed it in the same category to which the *Filaria perstans* has now been relegated; and still looked on the coccus as the causal agent. This contention has, apparently, been borne out by the fact that many animals inoculated with cerebrospinal fluid from cases of sleeping sickness have died at varying intervals from a coccal infection.

Dr. Mott[2] also has found in many of the recent cases of sleeping

sickness a coccal meningitis, but he is of opinion that this is an acute infection superimposed on a chronic lesion, the latter being due to an irritant acting through a considerable period of time.

It is well known that in acute inflammations we get a migration of polynuclear cells; in chronic cases, on the other hand, mononuclear cells are attracted. In the discussion at the British Medical Association Meeting on "The *Rôle* of the Lymphocyte," the majority of the speakers held the opinion that the lymphocyte was capable of active amœboid movements, and when attracted to a particular spot could pass through the wall of the blood-vessels and to a considerable distance through the surrounding tissues; and that in this migration, in contradistinction to the polynuclear cells, large numbers were not necessary, for the reason that the lymphocytes are capable of multiplication by division in connective tissues.

The condition in the brain of a sleeping sickness patient is a case in point, the chronic irritant present is the trypanosoma and the products of its metabolism; attracted by this, the lymphocytes migrate through the walls of the vessels into the perivascular canalicular spaces which are normally filled with cerebrospinal fluid. This fluid in health is destitute of cellular elements, but in sleeping sickness contains numbers of large and small mononuclear cells. In cases, however, in which death is due to a secondary coccal infection, large numbers of polynuclear cells are found, and, indeed, the fluid may become almost purulent. It has been proved over and over again that in cases of trypanosomal fever in man, although trypanosomata are numerous in the finger blood, they are not to be found in the cerebrospinal fluid; these cases are common in sleeping sickness districts, rare in districts where this disease is unknown. Again, in all cases of sleeping sickness the trypanosomata are found in the cerebrospinal fluid.

How is it that the trypanosomata can live in the blood of man for months or years, and give rise to little more than slight anæmia and transient œdema, whereas shortly after gaining entrance to the cerebrospinal fluid they cause grave symptoms and finally kill?

The train of events may conceivably be of the following nature. While it is in the blood the parasite lives upon the plasma; the products of its metabolism can be neutralised by the white cells of the blood and also by the cells lining the blood-vessels, these, however, being damaged somewhat in the process. When the parasite enters the cerebrospinal fluid, it has to live upon a fluid differing in its origin and chemical constitution from the blood plasma, and which contains no cellular elements; the products of

the metabolism of the parasite alter the chemical composition of the fluid, the result being that the nutrition of the brain is interfered with. In an attempt to correct this there is a migration of lymphocytes from the blood-vessels into the perivascular spaces, where they remain and cause compression of the capillaries, and thus the condition becomes aggravated.

The earlier stages of the disease, then, would be due to an alteration of the chemical composition of the cerebrospinal fluid caused by the trypanosomata, the lethargic stage due to the presence of the perivascular infiltration resulting in anæmia of the brain and its sequelæ. In this connection it must also be remembered that in sleeping sickness there is invariably an affection of the lymph glands throughout the body; these are enlarged and hæmorrhagic, and are the seat of an immense increase of mononuclear cells; the bone marrow also is affected and shows the same changes.

Further, a large number of the lymphocytes seen in smears from the brain show vacuolation of the protoplasm now it has been noted that large lymphocytes secrete bacteriolytic and cytolytic substances, and the evidence of this is vacuolation of the protoplasm. If these substances are discharged into the central nervous substance, it is possible that they have a share in producing the degenerative changes therein.

In speaking of animal experiments, Dr. Mott[2] says "the brains of monkeys inoculated with blood from sleeping sickness cases do not afford conclusive evidence of the trypanosoma being the cause of sleeping sickness. First, because only a few of the monkeys died; secondly, there is no proof that the animals that died really suffered from sleeping sickness, but rather that they behaved like animals profoundly ill; thirdly, no blocking of capillaries with trypanosomata nor any lymphocytic reaction around the vessels could be found; fourthly, in two or three cases there was an obvious diplococcal infection."

I hope to show in the following history of the case of a monkey lately under observation here that some of these conditions were fully fulfilled. This monkey was inoculated in Uganda by Colonel Bruce, in September, 1903, with 10 cc. of cerebrospinal fluid from a case of sleeping sickness. He came under observation here first on October 9th, 1903, he was then fit and well, no trypanosomata were found in his blood, but some "malarial" parasites were seen.

On October 23rd trypanosomata were first discovered in his blood, almost exactly six weeks from the date of his inoculation. The parasites continued in his peripheral blood until November 19th;

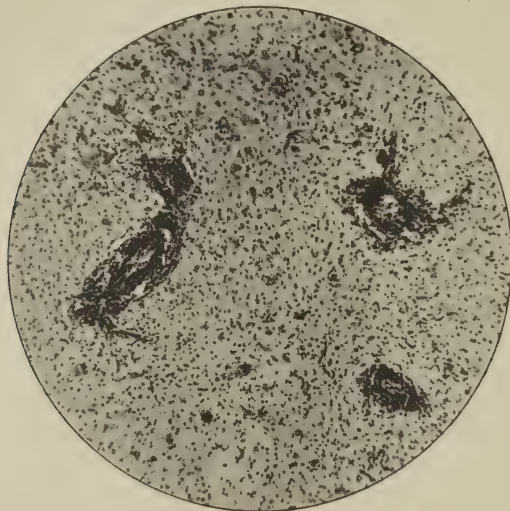

FIG. 1.—Photomicrograph of a section of sleeping sickness monkey's brain, from the region of the internal capsule. Stained by Leishman's method. Showing three small vessels with the perivascular infiltration. Magnification, 100 diameters.

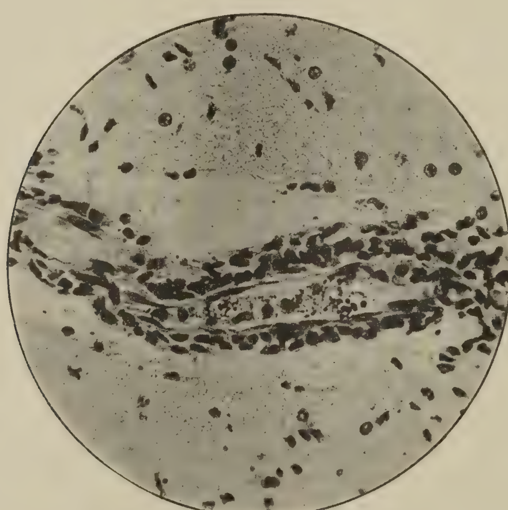

FIG. 2.—Photomicrograph of a section of monkey's brain. Stained by Leishman's method. To show filling of perivascular canalicular spaces with mononuclear cells. (During the process of hardening and cutting the sections, the mass of cells has been partially torn away from the wall of the space.) Magnification, 500 diameters.

(*Photographs by Corporal Gibbons, R.A.M.C.*)

after that date, in spite of careful scrutiny, none were found until December 16th, when they again appeared and were found up to January 4th, 1904, when they again disappeared. The blood was examined daily for some weeks from that date, but trypanosomata were not again found.

Thereafter, blood films were examined fortnightly throughout 1904, but no trypanosomata were seen. I am of opinion, however, that had it been possible to continue the close scrutiny of the blood, parasites would have been found in small numbers from time to time. During this period, although he got somewhat thinner, his health was otherwise good and he was very lively.

In February, 1905, it was first noticed that he was becoming weaker, the weakness affecting primarily the hind limbs; he also developed a slight puffy swelling about the lips and nose. The blood was again submitted to daily examinations, but it was not until March 5th, three days before his death, that one trypanosoma was found in a film made from finger blood.

The weakness was progressive, and his disposition also changed; he became irritable and nervous, snapping at any one who attempted to touch him, a thing he had never been known to do previously, and chattering loudly as long as any one remained in the room. His attendant declared that the tone of his voice had altered; this last symptom has also been noted in man, and is supposed to be due to an œdema of the vocal chords.

The hind limbs finally became completely paralysed, and this was followed by complete loss of power in the upper limbs. For the last three days of his life he lay prone on the ground, unable to move or eat; thirty-six hours before death he became comatose, and this condition of coma deepened into death.

The points of interest about the autopsy were, first of all, the presence of several much enlarged glands in the groin and axilla, which were of a deep purple colour, an evidence of a chronic trypanosomal infection.

The spleen was much enlarged and dark in colour, resembling a piece of black india-rubber in appearance and consistence.

Culture tubes inoculated with peritoneal fluid and spleen pulp remained sterile.

The lungs were healthy, there was no sign of tubercle or pneumonia, some clear fluid was present in the pericardium; cultivations from this fluid remained sterile and there was no deposit on centrifuging. A small quantity of fluid was drawn off from the base of the brain; this was slightly turbid, and on centrifuging the deposit

was found to consist of large and small lymphocytes and a few red corpuscles; no trypanosomata were found.

The skull-cap was then removed and it was found that there was no inflammation of the dura mater; on exposing the brain the convolutions were seen to be flattened and the vertex mapped out by turgid superficial vessels. About .5 cm. of fluid were withdrawn by means of a pipette from the lateral ventricles, and a film preparation made; on this slide four fully-developed trypanosomata were found. At the same time thick films from the heart blood were stained by the "wet" method, but although several were gone over carefully, no parasites could be found. Dry smears were also made from the cut surface of the brain, but the search here was again unsuccessful.

Sections were cut from the cerebrum, both cortex and base, also from cerebellum medulla and cord; in all of these the typical brain lesions of sleeping sickness were found, namely, a chronic meningo-encephalo-myelitis, the leading characteristics being a filling of the perivascular canalicular spaces with large and small lymphocytes, also an increase of connective tissue and degeneration of the neurones.

Sections of the brain were sent to Dr. Mott by Lieutenant-Colonel Leishman, and he agreed that the changes present were similar to those found in a well-marked case of sleeping sickness.

Cultures were made from the brain pulp and also from the cerebrospinal fluid, but remained sterile, and in none of the sections were any cocci seen.

To sum up, we have here a monkey inoculated with 10 cc. of cerebrospinal fluid from a case of sleeping sickness. He harbours the parasites in his blood for a period of eighteen months; during the first twelve months he is little inconvenienced, during the last four he becomes wasted, and suffers from a progressive weakness culminating in complete paralysis, coma and death.

At the autopsy the only film in which trypanosomata could be readily demonstrated was that from the fluid taken from the lateral ventricle of the brain. Sections of brain medulla and cord showed in a marked degree the typical and specific lesions of chronic sleeping sickness. Also to be noted is the entire absence of any bacterial infection.

With regard to the blocking of the capillaries by masses of trypanosomata, this does not occur in true sleeping sickness; it is found in the brain of animals dead of nagana and surra, and is not accompanied by perivascular infiltration. That trypanosomata

were present in the heart blood in this case was proved by the fact that a monkey inoculated with 5 cc. of heart blood showed trypanosomata in his blood three weeks later.

Cultivation experiments were made on McNeal and Novy's medium, but so far without result.

NOTE.—The animal experiments were performed by Lieutenant-Colonel Leishman.

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EGYPTIAN ARMY: THE MALARIAL CAMPAIGN IN THE SOUDAN, 1904.

By Major R. H. PENTON, D.S.O.
Royal Army Medical Corps.

The total number of admissions for malarial fevers throughout the Army was still high as compared with other diseases, and headed the list with 1,085, or 7·3 per cent. of the strength, against 1,297 admissions, or 8·7 per cent. of the strength last year. I have no doubt the reduction would have been more marked had not the troops been employed on active service up the Blue Nile (Colonel Gorringe's expedition) and White Nile (Bahr-el-Ghazal expedition).

In any case, however, there has been a most satisfactory reduction at the stations where the campaign against mosquitoes has had a fair trial for two years. It is a most encouraging fact that the returns this year show a marked diminution in the incidence of fevers in some of our highly malarious stations, especially Kassala and El-Obeid in Kordofan. There is good reason to believe, moreover, that a large proportion of the attacks were recurrent among those previously infected.

At Khartoum there were 159 admissions for malarial fevers, all Egyptian, with the exception of 18 Soudanese. Nearly all the admissions were from the Artillery (453 strong), who had recently been exposed to infection up the White Nile. The parasite was found in 54 per cent. of the cases. The prevailing type of plasmodium was benign tertain (83 per cent.), while 17 per cent. of the parasites were malignant. The results of treatment were as follows: 75 per cent. recoveries, 25 per cent. invalided, one death.

It is owing to the valuable services rendered by Dr. Balfour, Medical Officer of Health, and his staff, that Khartoum has been almost freed from mosquitoes and primary infection is of rare occurrence in that town. This is shown by the fact that young Egyptians seldom acquire the disease unless sent further south up the White or Blue Niles.

Dr. Balfour has found only one species of Anopheles at Khartoum, the *Pyretophorus costalis.* The larvæ were discovered in the palace garden tanks, river front, and pools left by the falling Nile, also sakkia pits, and wells. No other Anopheles have been found here, but *Culex fatigans* and *Stegomyia fasciata* were common before the campaign was instituted.

At Kassala the destruction of mosquitoes begun by Captain Ensor, D.S.O., R.A.M.C., and carried on by Captain Black, R.A.M.C., the present Senior Medical Officer, has produced remarkable results. This town was once highly malarious and full of mosquitoes and water-borne insects. It has been so thoroughly cleared of these pests that British officers now sleep without mosquito nets, and what is of greater importance, no cases of primary malarial infection have been reported, either among Europeans or Egyptian troops during the past rainy season, the first on record as regards the absence of primary infection. It is a remarkable fact that not one of the ninety-nine Egyptian soldiers stationed there was attacked. I have not the slightest doubt that many would have acquired malarial fever had they been exposed to infection, for speaking with considerable experience, they are exceedingly liable to fevers, and I have never known many escape if exposed to infection. In 1903 there were eighty-three admissions, many of them primary infections, and the rainfall was somewhat less (by 63 millimetres) than in 1904.

Amongst the Soudanese garrison, 7 per cent. of the strength suffered from malarial fever, but all the cases were reported as recurrent attacks, the immediate cause, a chill, especially amongst those addicted to marissa drinking (a native beer).

Captain Black generally found the benign tertian parasites in the blood, but in three cases (two fatal) the malignant parasite was discovered. In almost every case quantities of pigment were present. Large numbers of children were examined for enlarged spleen with negative results.

The health of the civil inhabitants at Kassala, judging from our civil hospital returns, has also improved. The admissions for malarial fever were old-standing and associated with profound cachexia. Kassala is a town of about 6,000 inhabitants. It is situate on low-lying ground, at the foot of the mountain of that name. There is little or no fall. In and around the town are numerous borrow pits and deep holes. The surface water during the rains flows into these hollows, forming breeding places for Anopheles. The main difficulty to contend with lies in draining away this water into the neighbouring Khor, which, generally dry, forms the River Gash in the rainy season, and flows past in a fine stream.

From May to the end of September the total rainfall recorded was 263·3 millimetres.

The mosquito work performed in this district under exceptional

difficulties from want of funds, is highly gratifying in its results, especially in view of the reported failure of the operations at Mian Mir, where doubtless the conditions must have been very unfavourable for mosquito destruction. I consider that great credit is due to Captain Ensor and his successor Captain Black, for their successful efforts. Every possible assistance was rendered by the Mudir, Major Wilkinson, without whose co-operation the work would have been impossible. Three mosquito brigades of thirty-six men were employed with picks, spades, wheelbarrows and petroleum. A great number of the larger pits were filled by the aid of a light temporary railway which proved of the greatest service. All pools were oiled whether they contained larvæ or not, and surface drainage was generally improved.

In the beginning of July during the rains Anopheles and Culex were found by Captain Black in five different parts of the town, the Anopheles generally in tanks, the Culices in surface wells. The brigades did their work so thoroughly that at no subsequent date were larvæ found, and the adult mosquito practically disappeared.

Malarial fever at Kassala was formerly serious and often of a dangerous type, although the plasmodium was usually benign tertian. After repeated attacks well-marked anæmia results, and the administration of quinine, in whatever form or quantity, is not very successful unless change of air is provided.

At El-Obeid, in Kordofan, where mosquito destruction was carefully carried out, there has been a satisfactory reduction by 10 per cent. of admissions for malarial fevers, but much remains to be done, as shown by the fact that 27 per cent. of the Soudanese garrison and 48 per cent. of the Egyptians were admitted to hospital. Nearly all those primarily infected were Egyptians. The civil inhabitants, especially Greek and Syrian merchants, are reported as having suffered less from fever than in previous years.

Lieutenant Hughes, R.A.M.C., to whom special credit is due for his exertions in dealing with the mosquito problem in this district, reports two varieties of Anopheles in Kordofan. The commonest is the *Myzomyia funesta*, found as a larva and adult imago.

A great deal of useful work has been done by filling up holes and borrow pits left when the old town of El-Obeid was built prior to the Dervish rebellion.

The following are some of the more important malarious stations in the Soudan where the campaign against mosquitoes has been carried out with varying success.

Mongalla (White Nile), 1,011 miles south of Khartoum, where there has been a reduction of 40 per cent. of admissions for malarial fever this year.

Wad-Medani on the Blue Nile, 120 miles south of Khartoum, a reduction of 2·2 per cent. In other stations on the White Nile, as at Fashoda and Tanfikia, 526 miles south of Khartoum, the destruction of mosquitoes has been unsuccessful and fevers have shown no diminution, but this is not surprising, as the close proximity of the swamps renders the destruction of mosquitoes impossible to accomplish.

Regarding the type of fevers in the Soudan, this seems to vary in different districts and is not always the same each year.

At Kassala the recurrent attacks were generally mild, quotidian and intermittent.

In Kordofan the fever is intermittent, lasting a week, the temperature varying from 102° to 104° F., but there seems to be frequently much prostration.

On the White Nile, although the fever was generally intermittent, the temperature was often high, and in some cases the bilious remittent form occurred.

Blackwater fever: Four cases occurred this year, one from the Blue Nile (British officer), two from the White Nile (Egyptian), one from the Bahr-el-Ghazal (Egyptian); of these four, one died and three recovered.

The death was that of a British officer on the Blue Nile, who, however, had previously suffered from an attack acquired in West Africa. This is the first recorded case from the Blue Nile, but I think it cannot be fairly attributed to infection from this district.

Blackwater fever is not met with in the Soudan further north than Fashoda on the White Nile, and rarely occurs there. It is more prevalent in the south and extends to the Bahr-el-Ghazal, where, I think, perhaps, the danger is greatest. Egyptians are more susceptible to attacks than Soudanese or even Europeans. The hypodermic injections of quinine hydrochlorate have, in our experience, proved most successful, and I have known no cases where untoward results could be fairly attributed to this method of treatment. A curious feature in the fatal case referred to above was the absence of parasites in the blood during the illness, although careful examination was made.

Anopheles or Malarial Carriers in the Soudan.

This is a subject which Dr. Balfour of the Gordon College Laboratories is investigating. In the light of present knowledge it

is impossible to say which are the carriers in different parts of the Soudan; it is, however, practically certain that in and around Khartoum the *Pyretophorus costalis* is the only culprit, and on the Blue Nile the *Pyretophorus costalis* and *Cellia pharœnsis* share equal honours, as they are proved by Dr. Balfour to be common in these parts.

Cellia pharœnsis is a well-known malarial carrier in Egypt, and is credited as the sole agent in conveying malarial parasites at Ismailia, which has, however, now been nearly freed from these pests. Coincident with their destruction there has, to my knowledge, been a remarkable reduction in the cases of fever in that town.

In November last I had ample opportunities for observing the Anopheles on the White Nile and Bahr-el-Ghazal, as I accompanied the Sirdar to Wau. We passed the dismal swamps through which the River Jur winds. The mosquitoes swarmed in countless myriads. Of the many different varieties I collected seven different species of Anopheles; Dr. Balfour has kindly identified them for me. A large black variety.

(1) *Myzorhynchus paludis*, which is very common on the Jur river and Bahr-el-Ghazal, near Meshra-er-Rek (latitude 9°). The most northern limit of this mosquito is at Goz-Abu-Gooma (latitude 13°), where I found a few species. It is not nearly so aggressive in its habits as other Anopheles, but is a proved malarial carrier (Christophers). It is found elsewhere, at Pretoria, Uganda and Central Africa, &c.

(2) *Pyretophorus costalis* (referred to above).

(3) *Anopheles Wellcomei*, recently discovered by Dr. Balfour as a new species at Bor and on the Sobat river. This mosquito swarmed in thousands on the Jur river and was most aggressive, hiding in the cabins and boldly attacking us in broad daylight. I have found this mosquito ten miles north of Gebel Ahmed Aga (latitude 11°), which is its most northern limit. It is probably the chief malarial carrier in the swamps of the Bahr-el-Ghazal.

(4) *Myzomyia funesta*, occasionally found on the Jur river, but plentiful at Meshra-er-Rek and Bahr-el-Ghazal. The northern limit of this mosquito is at Goz-Abu-Gooma (latitude 13°). It is a proved malarial carrier in British Central Africa, Sierra Leone, &c.

(5) *Cellia pharœnsis* (referred to above). I found only a few specimens in the Bahr-el-Ghazal.

(6) *Cellia squamosa*. I found only one specimen in the Bahr-el-Ghazal. Dr. Balfour informs me that it is the first Anopheles of

this species hitherto found in the Soudan. It is known to exist in Pretoria, Uganda, Masharaland, and elsewhere.

(7) *Myzomyia nili.*

The following is a list of mosquitoes I collected on my journey other than Anopheles :—

Odes squammipennis, a fine species, previously discovered by Dr. Loat at Gondokoro.

Mansonia uniformis.

Stegomyia fasciata, common everywhere in the Soudan.

Culex fatigans, prevalent throughout the Soudan.

Culex tigripes.

Tæniorhynchus auritus, a remarkable species common on the White Nile, south of Fashoda.

Purple tæniorhynchus.

MALTA FEVER IN THE MILITARY HOSPITAL, VALLETTA, MALTA, DURING THE YEARS 1897 TO 1904.

By Captain J. CRAWFORD KENNEDY.
Royal Army Medical Corps.
Member of the Royal Society Commission on Malta Fever.

This paper is the outcome of a study of the occurrence of Malta fever in Valletta Hospital for the last eight years, and its object is to contribute in some measure towards these two questions, viz.:—

(1) The infectious nature of Malta fever.

(2) The seasonal incidence.

(1) *The infectious nature of Malta fever* is considered with reference to (*a*) direct infection from infected to uninfected or to healthy individuals; (*b*) place infection. Accordingly, we require to determine the following facts: The number of patients suffering from some other disease who contracted Malta fever in hospital, and whether these were in proximity to infected cases; also, the number of Royal Army Medical Corps men contracting the disease, distinguishing between those who actually attended the sick, and those who lived in the hospital barrack-room, but did not actually handle the sick.

In determining whether a patient has contracted the disease in hospital, when I have no personal knowledge of the case, I have been guided by these principles:—

(i.) Exclude all cases that have been changed to Malta fever from simple continued fever diagnosed on admission.

(ii.) Exclude all cases diagnosed Malta fever within twenty days after admission. This, I think, is a fair limit, considering that the generally accepted incubation period is fifteen to twenty days, and then one must allow at least five days after the first day of invasion for an agglutinative reaction to appear in the blood serum. Even so, the probability is that some cases will be included that should not. Malta fever comes on so insidiously sometimes, and so often with merely a local manifestation, that the case is diagnosed according to the obvious local condition, and only recognised when the symptoms of a general or more severe invasion supervene. This was especially the case before the Widal's test came to be made use of to the extent it is nowadays.

For the sake of simplicity and conciseness, my results are presented below in tabular form:—

TABLE I.

LIST OF PATIENTS WHO HAVE CONTRACTED MALTA FEVER IN HOSPITAL SINCE 1897.

No. of Case	Regiment	Name	Disease for which admitted	Number of days in hospital before Malta fever diagnosed	Ward in which treated
1897					
1	Lancashire	Curling ..	Gonorrhœa	44	20 B.
2	West Riding	Burns ..	Inflammation of tonsils	35	34.
1898					
3	Royal Artillery ..	Smith ..	Gonorrhœa	83	20 B.
4	Suffolk	Millsom ..	Dysentery; incontinence of urine	92	20 A.
5	,, ...	Denton ..	Gonorrhœa; tubercle of lung	86	20 B.
6	West Riding	Parker ..	Primary syphilis ..	25	,,
7	Suffolk	Collyer ..	Enteric fever ..	44	20 A.
1899					
8	Royal Artillery ..	Brown ..	Contusion	47	D. H.
9	Derby	Williams ..	Gonorrhœa	29	20 B.
10	Lancashire Fusiliers..	Burrows ..	,, ...	62	,,
11	Royal Artillery ..	Finn ..	Primary syphilis ..	82	,,
12	Border	Green ..	Sprain	33	20 C.
1900					
13	Loyal North Lancashire	Ollerton ..	Fracture, jaw ..	101	20 A.
1901					
14	3rd Lancashire Fusiliers	Gammon ..	Pneumonia ..	47	34.
15	Royal Artillery ..	Lawson ..	Jaundice	60	20 A.
16	,, ,, ..	Notley ..	Abscess, D. P. ..	35	D. H.
17	5th North. Fusiliers..	Smith ..	Contusion	24	20 B.
18	Lancashire Fusiliers..	Wild ..	Gonorrhœa	26	,,
19	,, ,,	Wakefield	Soft chancre ..	51	,,
20	Royal Artillery ..	Cox ..	Gonorrhœa	30	Prisoners'
1902					
21	,, ,, ..	Smith ..	Conjunctivitis ..	81	24.
22	,, ,, ..	Baker ..	Secondary syphilis..	54	20 B.
23	,, West Kent ..	Butler ..	Gonorrhœa	43	,,
24	,, Garrison ..	Hall ..	Fistula in ano ..	40	34.
25	,, Artillery ..	Leith ..	Dislocation	114	20 C.
1903					
26	,, ,, ..	Wilkinson	Secondary syphilis..	42	20 B.
27	,, Garrison ..	Brett ..	Sore throat	33	D. H.
28	1st King's Royal Rifle Corps	Manning ..	D. A. H.	33	,,
29	1st King's Royal Rifle Corps	Godson ..	,, ...	42	20 B.
1904					
30	Royal Artillery ..	Martin ..	Dislocation.. ..	41	34[1].
31	Norfolk	Parker ..	Ague..	14	20 A[1].

[1] Both these men were discharged hospital after treatment for forty-one and fourteen days respectively. They fell ill seven and eighteen days afterwards, and had to be readmitted to hospital, suffering from Malta fever.

TABLE II.

VALLETTA GARRISON.

Year	1897	1898	1899	1900	1901	1902	1903	1904	Average
Average annual strength	3,799	3,291	3,283	3,185	2,943	3,550	3,298	3,522	3,359
Number of Malta fever cases	160	75	84	85	127	60	222	160	121·7
Number of cases per 1,000 of strength	42·11	22·78	22·54	26·68	43·11	16·90	67·31	45·42	36·23

TABLE III.

PATIENTS IN VALLETTA HOSPITAL.

Year	1897	1898	1899	1900	1901	1902	1903	1904	Average
Average number constantly sick	180·96	166·69	156·25	155·21	152·98	146·26	163·02	138·58	157·49
Number of Malta fever cases contracted in hospital	2	5	5	1	7	5	4	2	4
Number of cases per 1,000 constantly sick	11·05	29·99	32·00	6·44	45·75	34·18	24·53	14·43	24·79

TABLE IV.

ROYAL ARMY MEDICAL CORPS.

Year	1897	1898	1899	1900	1901	1902	1903	1904	Average
Average annual strength	50	55	58	37	33	41	60	65	50
Number of Malta fever cases	4	9	2	2	4	2	3	11	4·62
Number of cases per 1,000 of strength	80·00	163·63	34·48	54·05	121·21	48·78	50·00	169·23	92·4

TABLE V.

ROYAL ARMY MEDICAL CORPS AND ATTACHED ROYAL ARMY MEDICAL CORPS LIVING IN BARRACK-ROOM.

Year	1897	1898	1899	1900	1901	1902	1903	1904	Average
Average annual strength	55	55	55	55	55	55	55	60	55
Number of Malta fever cases	3	8	1	3	5	4	3	12	4·87
Number of cases per 1,000 of strength	60	160	20	60	100	80	60	200	88·54

It will be seen by comparing the total averages in the last columns of Tables II., III. and IV., that the liability to contract the disease among the patients in hospital, the garrison stationed in Valletta district, and the Royal Army Medical Corps men employed in hospital, is in proportion 24·8, 36·2, 92·4, or taking the liability of the garrison as 1, then the patients in hospital would be represented by 0·68, and the Royal Army Medical Corps men by 2·55.

First, with regard to the patients, let us examine Table I. One is struck with the comparatively small number, especially when one considers that the average number of admissions per year for the eight years is 2,902. It will be seen that opposite each patient's name is the disease for which he was first admitted to hospital, and the ward in which he was first treated; the study of these columns is interesting. The disability that shows up most frequently is venereal disease; the following table gives the numbers under each class of disease :—

TABLE VI.

Class of disease	Average yearly admissions, 1897-1904	Average constantly sick, 1897-1904	Average number of days spent in hospital by each case, 1897-1904	Total number of Malta fever cases contracted, 1897-1904	Average yearly number of cases Malta fever contracted in hospital, 1897-1904	Number of cases contracted in hospital per 1,000 admissions
Malta fever	121	20·22	61·00	—	—	—
Venereal	489	35·24	26·30	13	1·62	3·31
Injuries..	309	14·32	13·67	6	0·75	2·42
All other diseases ..	1,983	87·71	16·14	12	1·5	0·76
Total	2,902	157·49	19·80	31	3·87	1·33

The question immediately suggested is, "What reasons can be assigned for the apparent fact that those suffering from venereal disease supply the largest number of cases contracted in hospital?" In the first place, is the fact apparent, or real? By examining the above table one can see that it is real, because the number of cases of Malta fever per 1,000 admissions venereal is higher than any other disease.

We must examine, firstly, the length of time each case stayed in hospital; secondly, the ward in which treated; and thirdly, the possibility of infection from Malta fever patients.

It will be seen from Table VI. that venereal cases spend a longer time in hospital, on the average, than any others, except Malta fever. (Enteric fever is included in "other diseases.") It is also a fact

that all venereal cases are treated in one ward, viz., 20B, and as I shall show further on, this ward is in communication with other wards containing Malta fever patients. The reason must therefore be looked for in the above facts.

Below will be found a plan of the arrangement of the hospital wards, which explains itself, and also a table (VII.), showing the number of cases of Malta fever contracted in each ward. It will be seen, from a study of these, that twenty-six out of

TABLE VII.

Number of Cases of Malta Fever Contracted in Different Wards in Hospital.

Ward	Number of cases contracted	Number of beds contained	Whether Malta fever cases treated in hospital	Remarks
20A ..	5	50	Yes, all serious cases	This is the ward where all serious cases are nursed. Not confined to Malta fever or enteric fever. In the fever season as many as fifty Malta fever cases may be in at one time.
20B ..	14	60	No	Venereal ward.
20C ..	2	22	Yes, mild cases	This ward has on occasions been used as a surgical ward. Now used for trivial complaints and mild fevers.
20D ..	4	20	Yes, mild cases	Miscellaneous ward, and overflow of Malta fever cases from 20A.
34 ..	4	12	No	Surgical ward, situated on first floor overlooking Upper Quadrangle.
24 ..	1	6	No	Eye ward.
Prisoners'	1	6	No	Situated at main gate. Probability is that this case, on expiry of sentence, was transferred to 20B, where disease was contracted.

the thirty-one cases were contracted in the four divisions of the large ward; but that is only to be expected, seeing that over 70 per cent. of the beds are contained in this part of the hospital. Therefore, I do not think that we are entitled to judge from these figures that the large ward is worse than the other parts of the hospital, but it will be noticed how intimate is the connection between 20A (a ward at all seasons more or less full of Malta fever cases) and the other three wards.

The point that requires most attention is that the venereal cases have a longer average stay in hospital than any other disease except the fevers. The deduction is, of course, that the longer a man stays in hospital the more liable is he to contract the fever. This fact, I think, points more to a place infection than to infection by contact.

GROUND PLAN OF MILITARY HOSPITAL, VALLETTA.

(*Modified from Bedford's "Regulations of the Old Hospital of the Knights of St. John."*)

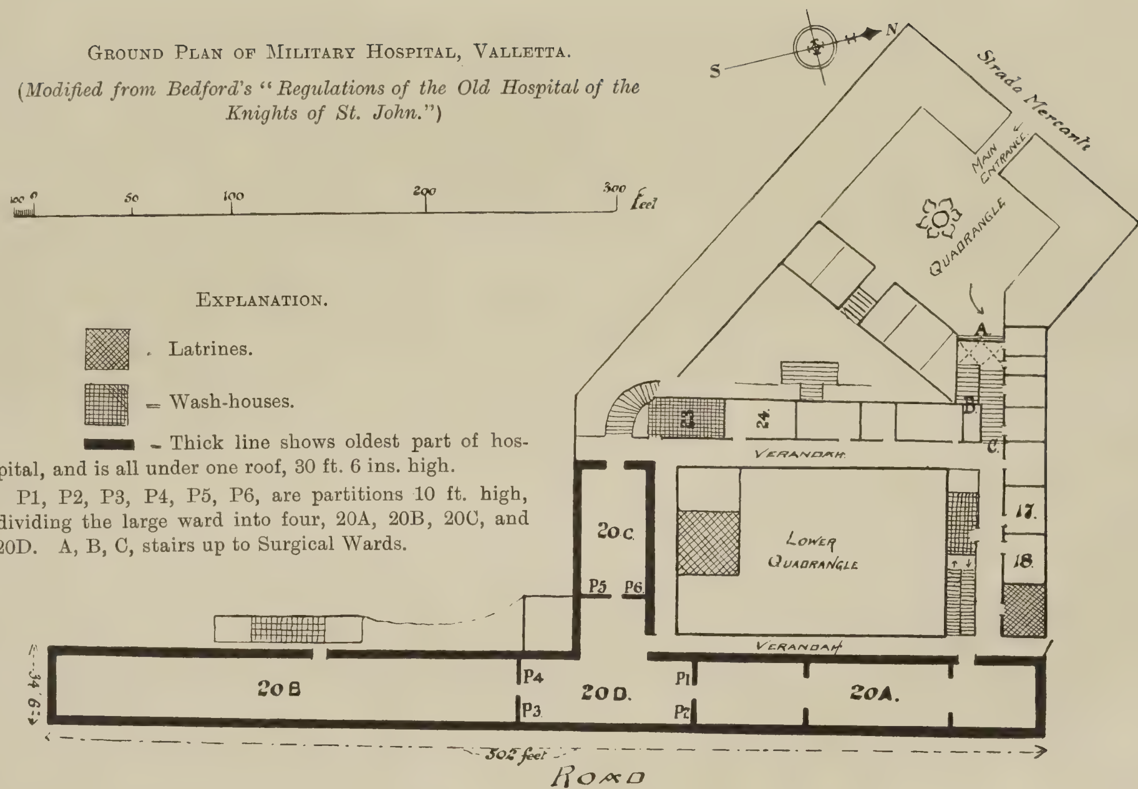
EXPLANATION.

. Latrines.

= Wash-houses.

– Thick line shows oldest part of hospital, and is all under one roof, 30 ft. 6 ins. high.

P1, P2, P3, P4, P5, P6, are partitions 10 ft. high, dividing the large ward into four, 20A, 20B, 20C, and 20D. A, B, C, stairs up to Surgical Wards.



This draws us to the next step—we at once think of those who stay longest in hospital, viz., the Royal Army Medical Corps and attached men living in the barrack-room, which is part of the hospital buildings. Table V. gives the figures for those living in the barrack-room. The number of cases contracted was thirty-nine for the eight years, with a yearly average of 4·87. The average annual strength is fifty-five; this gives a yearly case average of 88·54 per 1,000 of strength, being $2\frac{3}{5}$ times greater than the garrison, and $3\frac{1}{2}$ times greater than hospital patients.

The following is a list of men, Royal Army Medical Corps, Valletta, who contracted Malta fever during 1904, and a description of their duty.

TABLE VIII.

List of Royal Army Medical Corps who Contracted Malta Fever in Military Hospital, Valletta, during 1904.

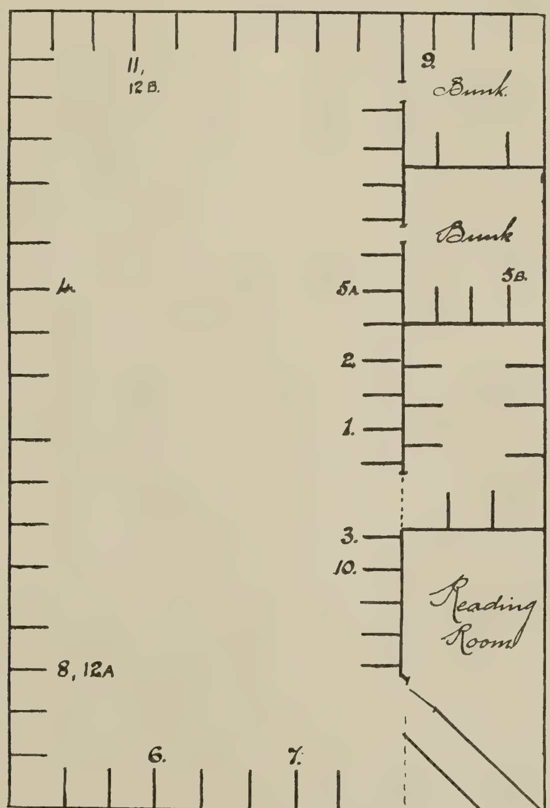
No.	Rank	Name	Age	Malta service, years	Date of admission	Section	Duty for three weeks previous.
1	Private ..	M. W. G.	$20\frac{4}{12}$	$1\frac{3}{12}$	Feb. 10	Cook	Cook-house.
2	,, ..	G. ..	24	3	,, 21	Nurse	20A, right side, since December, 1903
3	,, ..	L. ..	20	1	July 15	,,	20C.
4	,, ..	K. ..	22	$1\frac{4}{12}$	Aug. 6	,,	Night duty nine days before sick, 20A.
5	,, ..	C. ..	21	2	,, 13	General	Doing nursing duty 20A, night duty eighteen days before sick.
6	Staff-Sergt. .	L. ..	36	$\frac{11}{12}$	Oct. 4	,,	Pay-clerk.
7	Private ..	T. ..	21	$\frac{3}{12}$	,, 4	Nurse	20A.
8	Lance-Corpl.	B. ..	22	$1\frac{9}{12}$	Nov. 4	,,	37.
9	Private ..	B. ..	24	$2\frac{1}{12}$	,, 19	General	Cleaning utensils from 20A.
10	,, ..	M. R. ..	11	$1\frac{1}{12}$	Dec. 16	,,	Bâtman to Sergt.-Major.
11	,, ..	W. ..	22	$2\frac{2}{12}$	,, 30	Clerk	S.M.O.'s office.

TABLE IX.

	General duty section, &c.	Nursing section	Total
Average strength for year	45	20	65
Number of cases of Malta fever ..	5	6	11
Average per 1,000	111·11	300	169·23

Table IX. gives number of cases Malta fever per 1,000 strength, distinguishing between those who actually did nursing and those who did not. The same statistics are not available for previous

years, as it is only since the beginning of 1904 that the new regulations regarding the dividing of men of the Royal Army Medical Corps into nursing and other sections have come into force in Valletta. Previously to that, every man took his share, more or less, in actual nursing. Judging from Table IX., it would seem that men actually handling the sick are more liable to Malta fever than others, but one must not rely on conclusions drawn from such small statistics, as they are apt to be misleading.



POSITION OF BEDS IN BARRACK-ROOM. (*Not drawn to scale.*)

To Table VIII. might be added two other names, men who were attached to the Royal Army Medical Corps, and lived in the barrack-room, and who contracted Malta fever there, but did not attend the sick. A certain number of Royal Army Medical Corps men are married, and live outside the hospital, among them is Staff-Sergeant

L., therefore, the total number of men who contracted Malta fever while living in the barrack-room was twelve. Now what was the relation of these cases, the one to the other? Was there any chance of an infection from man to man in these cases? I give a plan of the arrangement of the barrack-room, with the number of the case put opposite the bed in which the man was for three weeks before going sick.

TABLE X.

No.	Name	Admitted	Remarks
1	M. W. G.	Feb. 10	Suggestive of a common cause.
2	G.	,, 21	
3	L.	July 15	All these beds far apart.
4	K.	Aug. 6	
5	E.	,, 13	
6	T. (attached R.A.M.C.)	,, 21	
7	F. ,, ,,	Sept. 19 ..	—
8	T.	Oct. 4 ..	—
9	B. (Lance-Corporal) ..	Nov. 4 ..	—
10	B.	,, 19 ..	—
11	M. R.	Dec. 16 ..	—
12	W.	,, 30 ..	When No. 11 went sick No. 12 took his place, but used his own bed-cot and bedding.

After a careful consideration of each case, I am unable to connect any two, except perhaps 11 and 12, though in the case of these the bed-cot was different; and 1 and 2, which happened within eleven days of each other. Therefore, I do not think this says much for the infectious nature of the disease.

Summary.—(1) Figures show that there are slightly more cases contracted in hospital, in proportion to strength (patients and Royal Army Medical Corps), than in the garrison as a whole (41 to 36 per 1,000 strength), this being due to the high percentage of Royal Army Medical Corps men affected.

(2) That the liability to contract the disease is greater amongst men living permanently in hospital than amongst the patients.

(3) That the liability of patients to contract the disease is increased in proportion to the length of stay in hospital.

(4) A study of cases occurring amongst men of the Royal Army Medical Corps during last year tends to show a greater liability of nursing orderlies and those brought in close contact with the sick.

Conclusions.—That Malta fever is not an infectious disease in the sense in which we apply the term to small-pox, scarlatina, or measles.

That Malta fever is a disease capable of being transmitted from person to person, probably by contagion.

That there is a strong indication of place infection.

(2) *Seasonal Incidence.*—Mediterranean fever is undoubtedly a disease which occurs all the year round, but it also undoubtedly is more prevalent during certain months of the year. The evidence of this is to be seen in the frequent occurrence of the disease in epidemic form. These epidemics usually appear in the summer or autumn months.

Below I give a table showing the number of admissions per month to Valletta Hospital during the years 1897 to 1904; also a chart showing the curve of monthly incidence obtained by taking the average number of admissions for each month during the eight years.

TABLE XI.

ADMISSIONS TO MILITARY HOSPITAL, VALLETTA, FOR FEVER PER MONTH.

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1897 ..	11	7	6	3	10	12	23	25	23	19	15	9	163
1898 ..	3	2	7	2	6	14	8	7	4	9	6	5	73
1899 ..	9	6	3	4	5	11	10	12	5	8	9	2	84
1900 ..	8	4	1	2	3	8	14	8	11	15	6	5	85
1901 ..	10	18	6	12	18	9	8	6	16	14	6	4	127
1902 ..	4	2	1	4	5	0	5	7	8	8	13	3	60
1903 ..	7	4	3	3	8	12	14	39	45	45	22	20	222
1904 ..	3	5	8	1	1	10	26	43	24	10	15	13	159
Total ..	55	48	35	31	56	76	108	147	136	128	92	61	973
Average..	6·8	6	4·3	3·8	7	9·5	13·5	18·3	17	16	11·5	7·6	121·6

Taking these figures as they stand, there would be no difficulty in naming the months during which the fever is most prevalent; but some remarks are called for in putting these forward.

It has been stated that the fever is as prevalent during the winter months as during the summer or autumn, and therefore my remarks shall be directed especially towards forestalling criticism.

In the first place, these figures include the cases that were readmitted to hospital for relapses of the disease contracted at a previous time; most of these readmissions occur during the beginning and the end of the year.

I have corrected the figures for 1904, as most of the cases came under my personal observation; for instance, there were sixteen

admissions during December, 1904, three of these were relapses; during January, 1905, there were fifteen admissions, but six of these were readmissions. A very common cause of readmission is the perineuritis which, as a sequel to the fever, is aggravated by the cold, damp climate.

It must, therefore, be admitted that had I been able to correct the figures for all the years the curve would have been still more pronounced.

Also it is a common thing for cases of Mediterranean fever to begin insidiously, and it may be a matter of two months even, especially if the man be married, before the case comes into hospital, but it is quite a common thing for the man to be ill for three weeks or a fortnight before he finally gives in. This also has a backward influence on the curve.

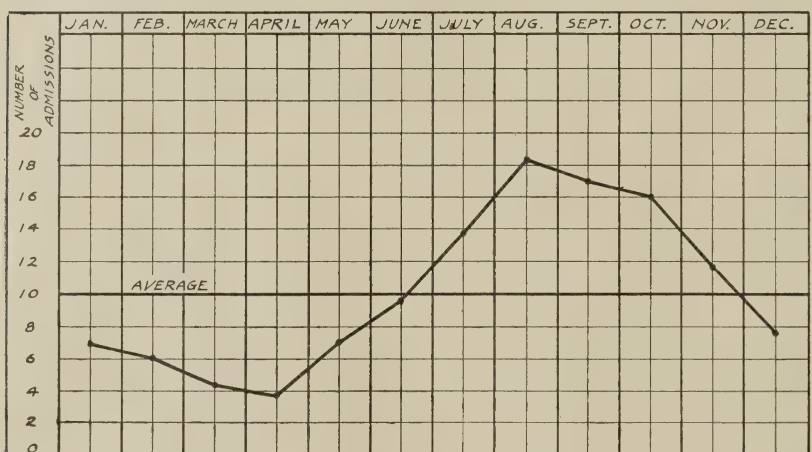


CHART SHOWING CURVE OF MONTHLY INCIDENCE, 1897-1904.

The following criticism may be passed and doubt placed on the value of these figures:—

That they deal with a population that is unstable and unacclimatised and that arrives in the island as far as possible at certain periods of the year. That these facts, taken in conjunction with the average period of time after which an unacclimatised person is most susceptible to the disease, may influence a seasonal incidence. I think this may be discounted.

The population being military is unstable as regards individuals, but constant as regards daily strength. It is otherwise with, for instance, the Fleet, which is away from Malta the greater part

of the summer, and in consequence the Naval Hospital gets more admissions for fever during the winter months. The regiments arrive in Malta, as a matter of fact, all the year round, but especially in the late autumn and spring. Below is a table showing the monthly arrival of regiments, excluding Royal Artillery and Corps, for the last eight years.

TABLE XII.

Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1	2	1	3	2	—	1	1	3	5	2	3	24

It will be seen that the majority of regiments arrived in the latter part of the year after the hot weather. This should have given them the best chance of becoming acclimatised.

As to acclimatisation, I am very doubtful if there is such a thing as regards Malta fever. Statistics point to a period between the first and second year as being the most susceptible to fever, but I am of opinion that a more prolonged stay in the island does not lessen one's susceptibility. Suppose a regiment arrives in autumn, then the most susceptible time for that regiment would be next autumn, and a regiment which arrived in spring would be expected to suffer next spring. Let us, however, see if this is the case.

TABLE XIII.

Month	1903		1904		
	Cameron Highlanders, arrived in September, 1902	King's Royal Rifles, arrived in October, 1902	1st Royal West Kent, arrived in April, 1904	2nd Essex Regiment, arrived in April, 1904	1st Rifle Brigade, arrived in April, 1904
January	—	3	—	—	—
February	—	—	—	—	—
March	—	—	—	—	—
April	—	—	—	—	—
May	—	—	—	—	—
June	2	5	—	6	1
July	2	13	3	17	1
August	2	31	8	15	11
September ..	4	35	4	13	3
October	5	36	3	2	1
November.. ..	—	20	3	6	4
December.. ..	1	15	6	2	1

Two regiments, the Cameron Highlanders and the 1st King's Royal Rifles, arrived in the autumn of 1902 (September and

October respectively). Three regiments, the 1st Battalion Royal West Kent, the 2nd Essex and the 1st Battalion Rifle Brigade, arrived in April, 1904. In Table XIII. I give the number of admissions per month from these regiments, up to the end of 1904 for the last three, and to the end of 1903 for the first two.

It will be seen from the above that the time of arrival in the island does not affect the incidence of the disease at a certain season, that the summer and autumn is the season during which the greater number of cases occur, whether the regiments arrive in the spring of the same year or the autumn of the previous year. I think, therefore, that a seasonal incidence as evidenced by these statistics cannot be denied. That the season begins late in June, reaches its height in August, and then declines, is well shown by the chart above. I have selected the three months of each year which show the greatest number of admissions for fever, and totalled the number of times each month appears. The following is the result :—

(1)	September is one of the three highest ..	.. 6 times.
(2)	July is one of the three highest ..	.. 5 ,,
(3)	August is one of the three highest .. October is one of the three highest ..	.. 4 ,,
(4)	June is one of the three highest ..	.. 2 ,,
(5)	November is one of the three highest May is one of the three highest .. February is one of the three highest	.. once each.

The months which appear with the greatest number of admissions in each year work out as follows :—

(1)	August is the highest ..	.. 3 times.
(2)	June is the highest .. October is the highest .. November is the highest	.. once each.

February and May equal, highest in 1901.
September and October equal, highest in 1903.

Conclusions.—That Malta fever occurs all the year round, but shows a decided preference for a certain season.

That the Malta fever "season" begins in June, rapidly increases till it reaches its height in August, and gradually dies down in September and October.

Clinical and other Notes.

NOTES ON TWENTY-EIGHT CASES OF POISONING BY ARSENIC.

By Captain S. T. BEGGS.
Royal Army Medical Corps (Militia).

History.—On the morning of November 1st, 1904, a number of soldiers in Palace Barracks, Holywood, obtained effervescing drinks from a hawker in Barracks.

The drink is popularly known as "fizz" among the men, a glass of which is bought for one penny. It was made by the hawker by adding a teaspoonful of "powder" to the glass of water. The men were all perfectly well before taking the drink, which was the first thing taken by all the cases that morning. In sixteen of the cases nothing of any kind was taken after the effervescing drink until the appearance of the symptoms; of the remainder, six had tea only and six had bread and tea. The hawker had been in the habit of buying tartaric acid and baking soda at the local grocer's and chemist's for the purpose of making this drink. In all, twenty-eight cases were brought to the Military Hospital, some being carried. All of them had partaken of the effervescing drink.

Signs and Symptoms.—On admission all the cases complained of severe abdominal pain and sickness. Vomiting in some of the cases was severe and incessant. Several of the men were more or less in a state of collapse. Cramps in the limbs set in later in sixteen of the cases.

Analysis of Symptoms.—(*a*) It was noted with reference to the time of onset of :—

(1) Sickness and vomiting: Shortest time of onset was ten minutes; longest time of onset was forty minutes; average time of onset was twenty-one minutes.

(2) Cramps in the limbs, &c. Average time of onset was two and a half hours from the time of taking the drink.

(*b*) *Part Affected.*—The lower limbs were affected in all sixteen cases as follows: Calf muscles of the legs in thirteen cases; feet (soles of feet and toes) in twelve cases; thighs (flexor muscles principally) in six cases; gluteal muscles in one case. The upper limb was affected in three cases; flexor muscles of forearm affected in three cases; flexor muscles of arm affected in one case; muscles of shoulder affected in one case. The muscles of the back of neck were affected in two cases. The diaphragm in one case.

(*c*) The average time of onset of symptoms was slightly shorter in

those cases not affected with cramps in the voluntary muscles than in the cases so affected.

(*d*) The severity of the case was in proportion to the muscular cramp. The most serious case experienced cramp in the toes, calf muscles of the leg, posterior and anterior muscles of the thigh, diaphragm, flexor muscles of the forearm, and muscles of the back of the neck; the cramp affecting the parts in the order indicated.

(*e*) The cramp began in the majority of the cases in the calf muscles of the legs.

(*f*) The flexor muscles were the ones chiefly affected.

Diagnosis.—The irritant and systemic symptoms lead to the view that the cases were due to acute poisoning by arsenic or ptomaine poisoning. A sealed sample of vomit from the patients was immediately despatched to an analyst, who reported the presence of arsenic in the vomit.

Source of the Arsenic.—The matter was investigated by the civil police authorities, but no definite conclusions were arrived at.

Treatment.—The treatment for arsenical poisoning was applied and resolved itself into: (1) Removing the poison from the gastro-intestinal tract; (2) treatment of collapse; (3) relief of severe muscular pain; (4) neutralising the poison in the system; (5) allaying the gastro-intestinal irritation; (6) dieting and after-treatment.

Prognosis.—All the cases improved under treatment. None of the cases showed dangerous symptoms.

Progress.—The acute symptoms passed off in a few hours after treatment was administered. The cases now obtained sleep. Some tenderness of the abdomen and the flexor muscles remained.

Result.—The cases were convalescent on the third day and discharged hospital on the seventh day.

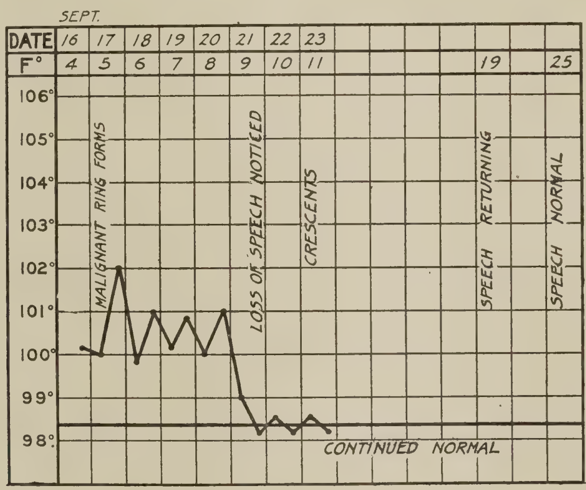
A CASE OF MALARIA (MALIGNANT TERTIAN) COMPLICATED WITH TEMPORARY APHASIA.

By Captain H. BROWNE-MASON.
Royal Army Medical Corps.

The patient, a "syce" boy, aged 11, attached to J Battery, Royal Horse Artillery, was admitted to the Cantonment Hospital, Rawalpindi, on September 16th, 1904. His father, who brought him to hospital, said that the boy had been suffering from fever for the preceding three days, and that to his alarm, during the previous night he had suddenly become "be-hosh" (without sense), and had vomited a good many times since then.

On examination the boy was found to be unconscious, his temperature was 100° F., and his pulse rapid and thready. The vomiting had ceased by this time, but he was very restless, and his condition rather recalled

the "irritation" stage of concussion. His spleen was slightly enlarged, but physical examination revealed no other abnormality. Next morning his temperature had risen to 102° F., the restlessness had disappeared and the unconsciousness deepened, his pupils reacted to light and both knee-jerks were normal. He was able to move all his limbs and no ocular or facial paralysis could be detected. The organic reflexes were intact. A specimen of his blood was examined with Leishman's stain and malignant tertian parasites were found, the small signet ring form being very plentiful. He remained without marked change for three days, when his temperature fell to normal. It was then noticed that he was unable to speak. He could understand what was said to him when he was vigorously roused, but quickly relapsed into an apathetic, somnolent state. His sight was unaffected and he had still no paralysis of facial or lingual muscles and his reflexes were unaltered.



From this time his apathy gradually cleared off, and by the eleventh day of his illness he could sit up and understand when spoken to, obeying simple commands in a perfectly intelligent manner, but he had no power of producing spoken speech. When he attempted to do so he pouted his lips and gave a strong forced expiration which only resulted in a voiceless whistling noise, at other times a faint voice sound was produced in the larynx, the lips then not being called into play at all. By this time the ring forms had disappeared from his blood, but crescents were present. As convalescence proceeded the power of speech quickly returned, and on the nineteenth day he was able to answer simple questions by monosyllables, and by the twenty-fifth he was running about and playing naturally. He was discharged cured on the thirty-fifth day. The treat-

ment was on general lines and directed against the malarial infection. He was seen again about six weeks after discharge and was then perfectly well.

The interest of this case rests upon the aphasic complication. On consideration of the symptoms it appears probable that, of the centres concerned, that governing the production of spoken speech was the one principally, if not solely affected, the apparent dulness of reception of speech being due only to the general condition. As the boy was illiterate it was impossible to test his powers of writing or of understanding written speech. From the rapid onset and gradual but complete subsidence of the symptoms, the lesion inducing the aphasia appears to have been plugging of the capillaries supplying Broca's convolution by the malarial parasite,[1] a view which is favoured by the large number of parasites present when the blood was first examined.

A CASE OF ANKYLOSTOMIASIS.

By Lieutenant-Colonel D. O'SULLIVAN.
Royal Army Medical Corps.

About November, 1901, a gunner of the 15th Company, S.D., R.G.A., was transferred from the Station Hospital, Dinapore, to that of Rurki, suffering from "Œdema." The diagnosis was not considered satisfactory by the medical officer who sent him, as in the transfer certificate he suggested the possibility of beri-beri. The patient had been at Dinapore only about three months and had come straight from Kowloon, in China, to that Station. I have seen a great deal of beri-beri in the Straits Settlements, and I was quite satisfied this man was not suffering from that disease. Whilst I was puzzling about the case the patient, about ten days after his arrival, suddenly developed enteric fever. This disease was almost certainly contracted during the railway journey, as the only other patient with him in the sick carriage also developed enteric fever at the same time. Samples of blood from both patients were sent to Major Semple at Kasauli, who reported that they gave positive reactions for enteric but not for Mediterranean fever.

It was quite the worst case of enteric fever I ever saw to recover; for over a week he appeared to be dying, and there was an offensive odour from his body that made the atmosphere of the ward he occupied nearly intolerable. He, however, made an excellent convalescence for a good while; and it seemed for a time as if the typhoid fever had brought about the cure of the original disease. A sharp attack of diarrhœa checked this progress; he again became profoundly anæmic; breathing was oppressed on slight exertion and the œdema of extremities returned. He became

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[1] *Cf.* Manson, "Tropical Diseases," third edition, pp. 79 and 80, 1903.

feeble and apathetic and took to his bed, where he lay almost always in a drowsy condition. He was brought before an Invaliding Board and sent home in January, 1902.

I was quite satisfied that in this case I was dealing with a disease that I had never before seen, and the appearance of the patient and the general character of the symptoms impressed themselves deeply on my mind.

A similar case came under my charge on the voyage home from India in the transport "Sicilia," which left Bombay on February 24th, 1903. This patient also came from Dinapore. He was a man of the King's Own Scottish Borderers. He stated that he had an attack of dysentery at Dinapore about June, 1902; on his recovery he was sent to Ranikhet, in July, and returned to Dinapore about the end of September. At Ranikhet he did not do well. He suffered there from diarrhœa and some fever, and on his return to the Plains he was very weak. He subsequently remained under treatment either in or attending hospital, until he embarked as an invalid for home.

When first seen by me he was so feeble that he was scarcely able to stand without support. He presented a remarkably anæmic appearance, the colouring being that of chlorosis. He was greatly emaciated, the face was "puffy," and the legs œdematous. His mouth and tongue were ulcerated. There was diarrhœa, the motions being of a dirty brown colour and exceedingly offensive. Hæmic murmurs were audible over the cardiac area, and a venous hum in the neck. The spleen was slightly enlarged. The evening temperature rose to 100°-101° F. There were no signs of hepatic abscess. The diarrhœa stopped, and the temperature dropped a degree in the evenings on a strict milk diet. Various remedies were tried, amongst others intramuscular injections of quinine, but he steadily lost ground, and when transferred to Netley on March 24th, he was in every way worse than when he left Bombay. During the voyage I came to the conclusion that the case was most probably one of ankylostomiasis, but there was no microscope available on board to determine the surmise. In the transfer certificate sent with the patient to Netley I stated my opinion, and recommended the examination of the stools for ova.

About May 1st last, when taking over charge of the Station Hospital, Belfast, I was, whilst going through the wards, forcibly reminded of the two foregoing cases by the peculiar chlorotic appearance of one of the patients. I learned that the man belonged to the King's Own Scottish Borderers, and that he was invalided from Dinapore in February, 1902, for anæmia. I suggested the advisability of examining his stools microscopically to search for the ova of *Ankylostomum duodenale;* but the patient had just been granted sick furlough, and, as he begged to be allowed to go away to his friends at the seaside he was discharged from hospital before examination could be carried out.

On April 30th his blood was examined by Dr. Beatty, Civil Surgeon, doing duty at the Station Hospital, Belfast, and Assistant Pathologist, Royal Victoria Hospital, Belfast, with the following result: Red cells, 4,350,000; white cells, 10,300; hæmoglobin, 56 per cent.

At the expiration of his furlough he again presented himself at hospital. He stated that his condition was much worse than when he left; he was much weaker, and his breathing was so short that he was scarcely able to walk. He had lost appetite and his legs were slightly swollen. His appearance was nearly that of a chlorotic girl. His face, though very pale, did not look thin; there was some puffiness under the eyes. His body generally appeared to be well nourished. There was slight pitting on pressure over the shin-bones and there were urticarial "bunches" on the right side of the abdomen. These bunches, he stated, had been a source of great annoyance to him for about two years; they affected, from time to time, almost every portion of his trunk; they were painful and irritable for a couple of days and then slowly faded away to recur in some other part of the body. Each bunch covered an area of about 4 by 2½ inches. He was taken into hospital July 6th, 1903, and two days afterwards an examination of his stools showed innumerable ova of the *Ankylostomum duodenale*. On the day of admission an examination of the blood showed red cells, 2,710,000; leucocytes, 13,000; eosinophiles, 15 per cent., and hæmoglobin, 24 per cent.

On July 13th, 1903, he got three doses of thymol, each 20 grs., in three successive hours, and the next morning he passed a stool that contained about 200 ankylostoma—190 were actually counted.

The patient gives the following history: "He is 26 years old, and has eight and a half years' service. He went to India in the beginning of 1897, passed the hot weather of that year in the Murree Hills; went with his regiment through the Tirah Campaign. At the end of the war his regiment went to Cawnpore, and he was sent on detachment to Fategarh, returning to Cawnpore in October, 1898. He remained at Cawnpore until February, 1901. Up to the rains of 1900 he enjoyed excellent health. Besides his ordinary duty as a corporal he was employed at the range, during musketry practice, in keeping the register and preparing targets. This exposed him a great deal to heat and wet, and he had often to work up to his ankles in mud. Whilst at the range he usually drank water that was brought by the *chaukidar* from the well of a neighbouring village and kept in *chatties* at the butts. He drank this water out of an enamelled bowl, which was always left floating on the top of the water. During the last four months of his stay at Cawnpore he suffered a good deal from ague, and when he went to Dinapore with his corps in February, 1901, he was, though doing his duty, in a weak state of health. His duties at Dinapore were similar to those at Cawnpore, and, as at Cawnpore, he drank, while on range duty, water brought by the *chaukidar* from the nearest village well. He steadily lost strength and appetite; he became

pale and short of breath, and it was at this time he first began to be troubled with the urticarial eruption. He was admitted into hospital for anæmia on September 20th, 1901. He states that shortly after his admission he suffered very severely for about a fortnight from griping pains, which invariably commenced at the epigastrium, extended thence to the right side and then downwards to the right iliac region, and finally affected the whole abdomen. Whilst suffering from these pains the abdomen does not seem to have been tender on pressure. Practically he remained under treatment from September 20th, 1901, until he was invalided home for anæmia in February, 1902. He was kept two months at Netley, and then was sent to the home battalion in Ireland. He states his condition was greatly improved on his discharge from Netley, but he was still far from his normal health, and above all, he suffered from shortness of breath on the slightest exertion. He went into the Reserve in June, 1902, but being unable to work in civil life he returned to the colours in November. In January of this year, 1903, he had a sharp attack of ague, and he remained so weak after it that he found it very difficult to do his duty. Finally, on March 18th, he was sent to hospital, as he dropped down during a route march the previous day.

There was considerable depression with nausea for two days after the thymol, and the stools contained a great deal of mucus. At this time he also began to suffer from severe supraorbital neuralgia, which lasted often two or three hours and recurred not only daily, but sometimes once or twice on the same day. He, however, felt much better, and was himself confident he was improving, though his general appearance did not indicate it. About July 29th ova of ankylostomum were again found in the stools, and on August 1st he had three ten-grain doses of thymol in successive hours. In the motion following the thymol three ankylostoma were found, and though the motions have been since examined no ova have been seen. He is now much improved, and is daily gaining strength. He is out of bed, and can walk about the ward. He says he feels quite a different man, and that the feeling of lassitude and depression he has had for years has left him. He looks better; the "puffiness" has left his face; there is no œdema of the legs; the murmurs in the cardiac region have almost quite disappeared, and there has been no urticaria since July 16th. Urine has always been normal. He is taking food well and with relish. The neuralgia has disappeared.

Dr. Beatty, assisted by Civil Surgeon Henry, has made several examinations, and I am much indebted to them for assistance in examining blood, &c., in this case. A note on blood examinations by Dr. Beatty and Civil Surgeon Henry is appended.

NOTE OF BLOOD CONDITION BY DR. BEATTY.

The cells were counted with a Thoma Zeiss apparatus, using for the red blood corpuscles Joisson's diluting fluid, and for the white a ·3 per

cent. solution of glacial acetic acid. The hæmoglobin was estimated by the ordinary Gower's instrument, and once by the Haldane-Lorrain Smith method as a control, there being often a considerable error in the Gower's method for low readings. The coagulation time was estimated by Wright's tubes. The films were stained with Leishman's modification of Romanowsky's stain. In the differential leucocyte count 500 leucocytes were counted. In each case the examinations were made between twelve and one o'clock in the day. The classification is that of Ehrlich. A single normoblast was seen, but no megaloblasts and only a few megalocytes; poikilocytosis was present to a small extent.

The first examination was made on April 30th.

Red cells	4,350,000	No differential count was made;
White cells	10,300	a rather doubtful eosinophile leuco-
Hæmoglobin	56 per cent.	cytosis was present.

On July 6th a count showed:—

Red cells	2,710,000	
White cells	13,000	
Hæmoglobin	24 per cent.	by Gower's.
,, ...	21·6 ,, ,,	,, Haldane-Lorrain Smith's.

Differential count:—

Polymorphonuclears	77 per cent.
Lymphocytes	8 ,, ,,
Eosinophiles	15 ,, ,,

On July 15th (thymol administered on the 13th):—

Red cells	2,320,000
White cells	6,580
Hæmoglobin	25 per cent.
Polymorphonuclears	78 ,, ,,
Lymphocytes	8 ,, ,,
Eosinophiles	14 ,, ,,

On July 21st:—

Red cells	1,830,000
White cells	8,000
Hæmoglobin	25 per cent.
Polymorphonuclears	65 ,, ,,
Lymphocytes	20 ,, ,,
Eosinophiles	15 ,, ,,

Coagulation time was 8 minutes 45 seconds.

On July 23rd:—

Polymorphonuclears	63 per cent.
Small lymphocytes	15 ,, ,,
Large ,, ...	3 ,, ,,
Eosinophiles	18 ,, ,,
Mast cells	1 ,, ,,

Coagulation time was 8 minutes 35 seconds.

On July 27th :—

Red cells	2,740,000
White cells	8,000
Hæmoglobin	32 per cent.

On August 8th :—

Red cells	3,780,000
White cells	9,200
Hæmoglobin	40 per cent.
Polymorphonuclears	48 ,, ,,
Small lymphocytes	13 ,, ,,
Large ,, ...	4 ,, ,,
Eosinophiles	35 ,, ,,

Coagulation time, 7 minutes 43 seconds.

The probable dependence of the urticarial condition on the coagulability of the blood suggested to me the advisability of testing the coagulation time as suggested by Professor Wright. This I performed on five occasions, and in all of them I found it very much increased; the normal time is stated to be from three to six minutes, but in this case it was on each occasion about double.

NOTE OF BLOOD CONDITION BY CIVIL SURGEON HENRY.

	Red cells.	White cells.	Hæmoglobin.
August 23rd, 1903 ..	4,950,000 ..	6,850 ..	50 per cent.
,, 28th, ,, ..	5,170,000 ..	6,500 ..	58 ,, ,,
,, 30th, ,, ..	5,460,000 ..	6,000 ..	58 ,, ,,
September 6th, ,, ..	6,140,000 ..	6,200 ..	70 ,, ,,
,, 11th, ,, ..	6,360,000 ..	5,400 ..	80 ,, ,,

A CASE OF ACTINOMYCOSIS.

By CAPTAIN F. F. CARROLL.
Royal Army Medical Corps.

History of Case.—Patient was only enlisted in December, 1904. For two years previous to enlistment his occupation consisted in driving a threshing machine, and he stated that he used constantly to chew straw and eat grain. In May, 1904, he first noticed a slow, painless enlargement of the left side of his face and lower jaw. This subsided after some weeks, but a hard lump could always be felt in the submaxillary region. Again in December, 1904, he suffered from an acute gumboil and was admitted to hospital. On admission, the last lower molar tooth on the left side, which was hollow and from which pus could be seen issuing, was extracted. The swelling, however, did not subside, but continued to track downwards beneath the ensheathing layer of the cervical fascia. When seen in February, the whole left side of the neck from the ramus of the jaw to the clavicle presented a very typical appearance. The skin was dusky red, brawny and infiltrated,

and the whole area quite painless to the touch. On February 3rd, 1905, patient was placed under chloroform and the affected region incised in about six places. A large quantity of broken-down caseous material was removed by the finger and curette. A bacteriological examination of the pus kindly made by Major Tatham showed the typical mycelium. The first attack in May, 1904, was probably a pure infection. The case, which was of three months' duration, had now almost recovered. The treatment employed consisted of local antiseptic dressing of the sinuses and iodide of potassium internally in large doses (90 grs. daily).

THE CARE OF ARMY CHILDREN'S TEETH.

By A. F. A. HOWE.
Dental Surgeon South and South-East Districts.

A large number of married men in the army do not realise the importance of teaching their children to clean their teeth. As many of the boys subsequently enter the Services, and some of the girls ultimately become the wives and mothers of Service men, the acquirement of habits of dental cleanliness at an early age benefits the State as well as the individual, and its value cannot be over-estimated. It is desirable that all children attending Army Schools should receive regular dental treatment, but this does not appear to be practicable at present, owing to the small number of Army Dental Surgeons employed. Much, however, might be done by means of occasional short lectures to the children, who should be instructed in the proper method of cleaning the teeth, stress being laid upon the importance of *daily* use of the tooth-brush. Such lectures could be delivered by Army Dentists at the various stations visited in the ordinary course of duty; they need not exceed ten minutes in duration, and could be given at the Schools in the afternoons.

Similar lectures might also be arranged for the parents, and the process of dentition could be simply explained. The popular misapprehension that "it does not matter about the milk teeth" is responsible for a great deal of unnecessary suffering during childhood, and a considerable amount of dental trouble in after-life; lectures on the lines suggested would tend to remove this, by showing the relation of the temporary teeth to their permanent successors.

Children's tooth-brushes should be on sale in the canteens; it would not be necessary to keep a large stock, but it is important that the brushes should be of the proper size, and that the bristles should be soft.

Philosophy, Travel, &c.

WEST AFRICAN BUNDOO.

By Captain L. F. SMITH.
Royal Army Medical Corps.

A short time ago, when up in the bush some distance from Freetown, my servant came to me one day and said, "They go pull Bundoo in two three days." As I had been extremely anxious to see the performance I told him at once to go and find out when it would come off. He came back and said he could not find out, but three days afterwards a petition came from the King that his "Santigi" (minister) might be allowed to have a dance all night at his place, and then I at once guessed that the Bundoo would take place next day. My boy went to the Santigi to find out, and then told me he would call me early if the next morning should happen to be the one selected. Four o'clock next morning found him waking me up, and after a cup of tea, we started out in the pitch dark and stumbled along a narrow path to an outlying part of the town, in which the Santigi lived. About 5.30 a.m. I got there and entered the yard, as the open space surrounded by native huts is called. The family and relatives and dependents of a "big" man live in the surrounding huts, and in the yard their dances and tom-tomming take place. From this yard, as I approached, loud sounds of tom-tomming and other concomitant discords proceeded. Being given a chair in a verandah of the chief hut, the Santigi informed me that they would make a move as soon as it was light. In the meantime I employed myself watching the dance which was going on, and was composed about equally of men and women, who waddled and sidled and cake-walked round in a circle, occasionally one, strung up to a high pitch of excitement, leaping into the centre and executing a *pas seul*, twirling round and round, and jumping as high as possible into the air. All the time the dancers waved their arms above their heads, holding for the most part rattles in their hands, or sticks on which iron rings were fastened. With these they kept time to the tom-tomming of three men seated in the circle, and at the same time they and the bystanders kept up a monotonous chant. This had been going on the whole night, since 8 p.m. the evening previous, so that when I saw them they were

a trifle warm, and the aroma of negro is better imagined than appreciated.

Dawn soon, however, began to break, and at 6.10 the dance stopped and the Santigi said it was time to move. The boys about to undergo the operation had been kept for a day or two previously in this house, apparently partly as a precautionary measure, as at times they become frightened and bolt into the bush till the palaver is over. The music and dance is designed to occupy their attention and prevent them becoming too much alarmed.

Accompanied by a crowd of natives I followed after the boys, who had left the house some time previously, and made my way along a narrow path into the bush close by. Following the path for about three-quarters of a mile, I came on a further crowd of natives, and saw an old man, with a naked sword in his hand, talking and gesticulating. He said that there were too many coming to see the performance and that he did not think I should be allowed in. They are very particular about allowing in any one who has not passed the ordeal, and dislike white visitors very much.

However, the Santigi came up and passed me in and we went along a narrow path recently cut in the dense bush, for about thirty yards, the path twisting and turning so that nothing could be seen from the outlet.

The operation was about to take place, and I saw twelve naked boys in a row, standing according to size, the tallest being on the left and the shortest on the right. One small boy had a red string round his arm which was removed the moment it was noticed. The eldest appeared to be about 16, and the youngest 10. They were trying hard to appear unconcerned, but some of the elder boys seemed a bit nervous. Close behind each boy stood a man, and in front also a man stood about two paces away.

Further up the passage in the bush a fire was burning, and on it a pot containing some boiling infusion. A plate, full of yellowish-red, viscid fluid, looking like sap from a tree, was lying on the ground beside it. A little further on the bush was cut away into a small circle, and little seats were here made about a foot from the ground by tying a cross-piece on two uprights.

I had only time to glance at these things when I saw an old native come forward in front of the biggest boy and seize his penis in his left hand, holding his right hand behind his back. He felt carefully all over the glans and then drew the foreskin well forward. At the same time the man behind the boy put up his arms to steady him, the operator's right hand was drawn from behind his back, hold-

ing a knife, and he immediately began to cut off the foreskin well in front of the glans. The first incision only cut down to the mucous membrane, as the knife was blunt, so he began a sawing movement, and gradually, by pulling and sawing, he severed the prepuce. The moment he was finished with this boy he passed on to the next. The boy just finished was at once seized by the man standing in front of him, who stepped forward and seized the penis between the finger and thumb of both hands, pushed the mucous membrane well back, so as to be clear of the glans, and drew the skin of the penis to meet it. Holding the cut parts in apposition, and compressing the penis to stop the hæmorrhage, the two men, one behind and one in front, helped the boy to one of the seats in the circle and made him sit down. Previous to the operation the man in front had filled his mouth with some small berries and chewed them, and when the boy sat down he at once expectorated on the cut surface, and a deposit was immediately formed, much the same as occurs when iodoform emulsified in ether is poured on a wound. These berries, the man told me, were a species of pepper, and smarted the boy extremely. Then another man came along with a colourless liquid, contained in an old scent bottle, and dropped one or two drops on the wound. After him came another with a cloth soaked in the infusion in the pot and squeezed it over the penis. As this was nearly boiling hot it was not very comfortable for the boy. After this an egg was broken and the contents poured over. This egg contained a chick, but I could not find out whether it was necessary that it should be in this condition or not, but as a fresh egg is not always easy to procure, I fancy the general custom is the above. All the time this was going on with the first boy the operator was proceeding to deal with the others in turn. He changed his knife after he had finished the first boy, discarding the one he had used, a straight thick blade in a wooden handle, in favour of a nickel pocket-knife of American make. It, if possible, appeared to be blunter than the other, and there was more sawing and less cutting as he proceeded down the line. Eventually, all were more or less circumcised, and I went into the circle to watch the dressing. They were all treated in the same way. The bleeding was very slight, and after holding the penis for a short time and applying the above-mentioned remedies it stopped, and a few strips of clean rag were put on, and the proceedings came to a close.

Not a sign or movement was made by any of the boys, except a slight squirming when the sawing was very pronounced, this calling forth a warning sound from the operator and a word of encouragement from the friend behind. Each resolutely watched the other

boys till his own turn came, and only one little boy made a sound like a sob when he was put sitting down. The application of the medicine, judging from their faces, caused much more pain than the cutting itself.

The further procedure is as follows: They remain in the bush till the afternoon, when they are taken a short distance away to a palm-leaf hut, specially built for them, where they remain till they are healed. They are fed entirely on eggs, rice and fruit, in order, they say, "to make them heal good fashion." They then are clad in white and after that in fantastic dancing garments and come back with flags waving, have a big dance, and the matter is finished.

The Santigi told me his lot, as a rule, took twenty days to be cured, but if one is backward he delays the rest, as they wait till he is ready before coming back. During the time of treatment they undergo instruction in manly duties.

In some ways this particular bundoo differs from the description given me by an officer who had the good fortune to see two in a place twenty-five miles further in the bush. There they tom-tommed all the time it was going on, to drown the cries of the victims; in the one I saw, knowing this, I enquired where the music was, the answer being, "we only use it for women, men here make no noise"; man being represented by a small boy of ten or thereabouts. Also there was no particular bundoo dress for the operator, when I saw it, whereas at the other, the operating suit consisted of a dress something like a jester's, cap and all.

Later in the day, when the boys had gone to the hut, the bundoo devil would appear—a man with a large mask on with beard of grass hanging down to his knees—and dance before them.

On the way back I passed a hut in which four girls were living who had been "bundooed" the evening before. In their case the clitoris is removed, in order to make them more faithful to their husbands, but as men are not allowed to see the operation, I cannot describe it. Women, of course, are not allowed to see the men's palaver, and if a woman does not keep out of the way and hears a man cry out or sees a drop of blood drawn at the operation, some dire misfortune is in store for her, according to native belief.

The tom-toms are kept going while the women are being done, as their shrieks otherwise can be plainly heard.

This is a slight description of a very interesting performance in which the methods are crude, but the final results, as a rule, extremely satisfactory. If a boy escapes (and generally they do not want to) and grows up without being circumcised, he becomes a laughing stock of all, especially women.

THE ORIGIN OF LIFE.

IV.

By Lieutenant-Colonel BRUCE SKINNER.
Royal Army Medical Corps.

Although the Permian sediments continued uninterruptedly upwards from the Carboniferous, yet there were large tracts of country where the rocks laid down in the latter period were raised above the sea-level. These rocks consequently afford an opportunity of obtaining a general idea of the distribution of land and water after the Carboniferous period. This distribution can be mapped out roughly to-day wherever two conditions of the crust can be recognised; one where sedimentation continued from the Carboniferous through the Permian to later rocks indicating that a region presenting such a condition remained beneath sea-level; another where sedimentation did not occur over certain large areas of rocks of Carboniferous and preceding formations for a longer or shorter period.

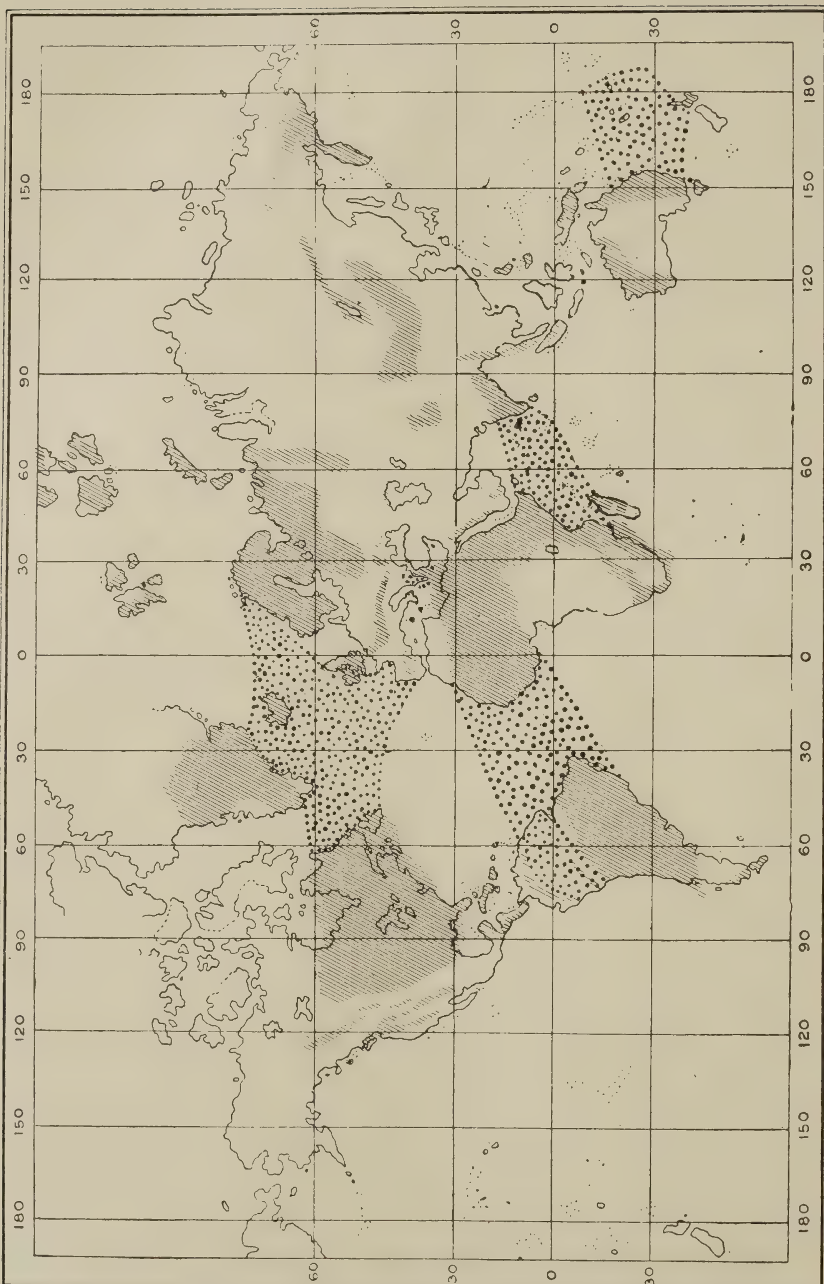
The latter condition is well illustrated in the region of the modern Sahara and Soudan, where Cretaceous rocks lie upon marine Carboniferous. It is obvious, therefore, that the Carboniferous rocks were not covered by water during the interval between them and the overlying Cretaceous; in other words, a continent existed there during that interval.

On the northern edge of Africa, in the region of the Atlas range, rocks of all the geological periods, from the Permian onwards to the Eocene, are visible, showing the presence there of a sea continuously during that time. This condition illustrates the former series above referred to.

Perhaps the most striking illustration—the word startling may even be applied to it, showing as it does how the seas of old are now at elevations seldom excelled by mountains in any other part of the world—is the region to the north of Peninsular India, where the mountains show marine strata of periods extending in unbroken succession from the oldest rocks, which here are Pre-Cambrian, up to the later Eocene. We have here presented to our vision the evidence of a great sea which continued undisturbed until that post-Eocene epoch when the lands and seas of the earth underwent an almost complete *bouleversement*.

Peninsular India, including Ceylon, has probably always been a land; there are no deposits to show that it was ever completely

CHART I.



PLAN OF THE POST-CARBONIFEROUS LAND.

Shading indicates known land areas. Pointing indicates probable land areas.

submerged. Further, it is a portion of land which extended west and south-west, to Southern Arabia, Abyssinia, and the Zanzibar coast, including the Seychelles, and sending out a peninsula in the region now occupied by Madagascar. From Abyssinia westwards this land was connected with the Saharan continent after the Carboniferous period.

From the Zanzibar coast the land extended southwards to the Transvaal, Damaraland, and the Cape of Good Hope, enclosing an area within which there was a large inland sea; the sediments formed in this sea are without any marine fossils, but contain the remains of animals and plants whose characters are those of the Trias of Europe.

The Carboniferous rocks which help to form the margin of this inland sea of South Africa contain some traces of the flora of that period. They were deposited in close proximity to land. After their deposition came the period of their displacement. By this means the basin was formed within which were laid down conglomerates of enormous rocks, the early *débris* of the crumpled marginal land. Contemporaneous deposits found in India (Tálchir) possess a somewhat similar conglomerate. In South Africa the Triassic deposits succeeded the conglomerates. (See Journal, vol. ii., p. 261.)

This basin of deposits, generalised under the name "Karoo," contains reptiles and trees washed down from the adjacent land; the trees are represented sometimes by coal, sometimes by masses of silica preserving the forms entire of uprooted trunks, which have lain undisturbed upon the mud-banks to which they drifted in that far-back time. The reptiles we shall refer to shortly; but it may here be noted that the crocodiles, first found in the Triassic deposits of the North, do not occur in the Karoo, though they had reached the next higher series (Upper Gondwána) of India. If the crocodiles succeeded in reaching South Africa in the Jurassic period, their remains are not found as fossils in deposits either of the Karoo, or above it. Soon after the deposits immediately succeeding the Karoo had been completed, the portion of the continent composing modern South Africa was raised so as to become entirely land; there remained no inland sea to preserve fossils of any description. Further, the elevation of South Africa was accompanied by volcanic conditions. The outpourings of vast sheets of lava which then took place covered over the deposits containing the strange reptiles, some of which may be seen in the Natural History Museum, and rendered this country one to be avoided by all animal life. A later and more tranquil age was required for its repopulation by newer races travelling south from other lands.

After the Triassic period the eastern side of this southern part of the continent became further submerged; the sea above it became ultimately connected with that Cretaceous sea which later extended up the Madagascar Straits to the eastern coast of India.

From the attached plan a rough idea may be acquired of the continents of the Permian period. This will prove of assistance in considering the geological distribution of the animal life of the periods immediately following the Carboniferous. The deposits on the margins of the continental and insulated land surfaces are those from which we obtain the fossils of the Reptile life of this time. There appears to have been a northern and a southern continent, the nearest communication between which was by land extending southwards from the vicinity of the Adriatic, over the Eastern Mediterranean to the north coast of Africa.

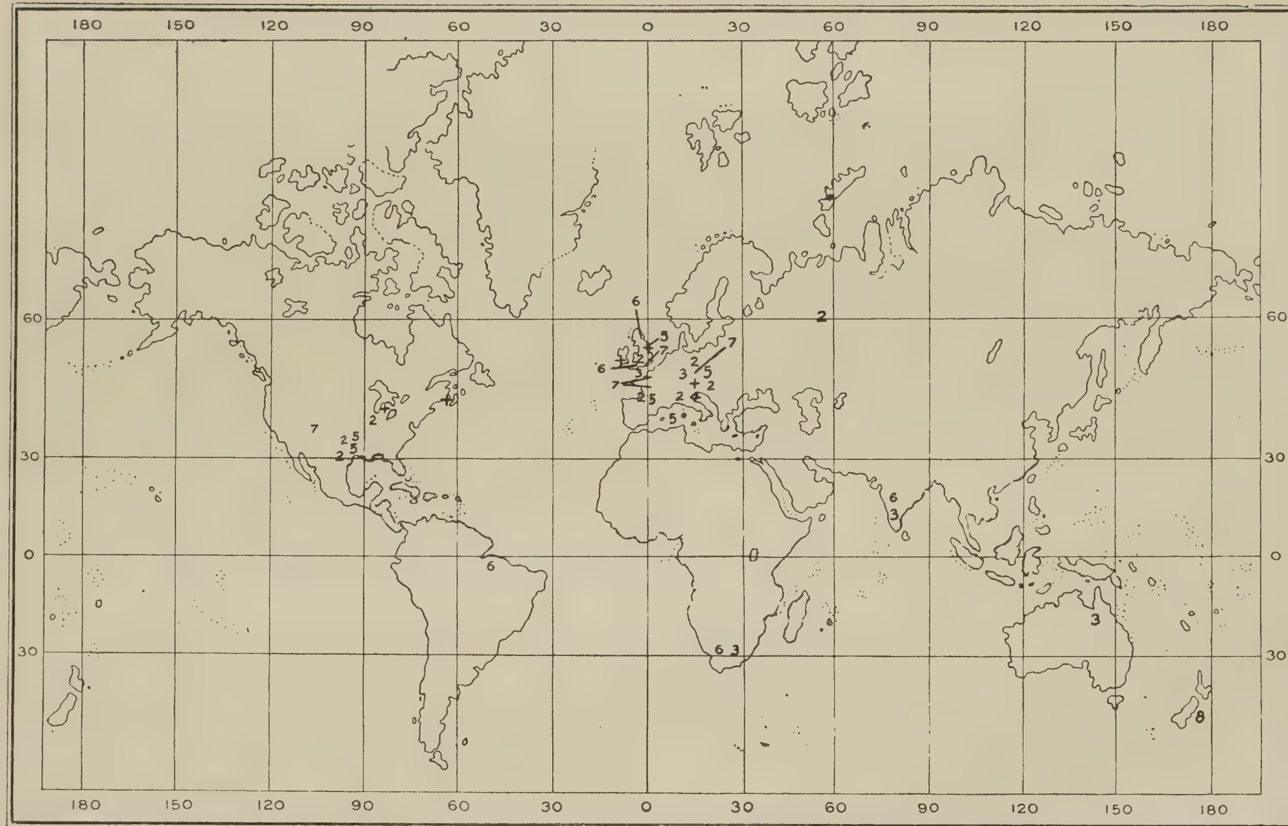
From the distribution of the land here shown may be seen the routes by which the reptiles travelled, dispersing themselves over the world in such manner that similar reptilian remains have been discovered in widely separated regions. By comparing the dates of appearance of the orders of animals in the rocks of various localities, it is possible to obtain a fair idea of their progression from the northern continent to outlying places. It is perhaps necessary here to remind the reader that the land forms would be preserved only in the fluviatile or lacustrine deposits of the periods during which they lived. Unfortunately many such deposits have either disappeared in the course of the changes which have occurred in the geography of the world, or if they exist they have not yet been adequately explored.

The *Amphibia*, previously noted (Journal, p. 390) as occurring in the Carboniferous period, continued up to the end of the Triassic. They then disappeared. Their distribution is shown in Chart II. The modern *Amphibia* belong to other orders which do not appear as fossils until the Cretaceous period; from this period they continue to the present day.

But though the older *Amphibia* died out at the end of the Triassic period, they had extended as far south as Australia and South Africa. The genus found in Australia occurs also in South Africa.

The latest family of the *Amphibia* occurs in the Trias of Germany and Upper Trias of England, India, and South Africa; the members of this family are the possessors of teeth with an elaborately labyrinthine arrangement of the dentine. The earliest *Amphibia* had smooth conical, hollow teeth.

CHART II.



Time and Place Distribution of
- Amphibia ..
  - +—Carboniferous.
  - 2.—Permian.
  - 3.—Trias.
- Earlier Reptiles
  - 4.—Lower Permian.
  - 5.—Middle and Upper Permian.
  - 6.—Trias.
  - 7.—Jurassic to Lower Eocene.
  - 8.—Recent.

We have now to sketch a new class of beings—the Reptiles. Of these, the first order (the earlier reptiles) is first found in the Lower Permian of Germany and of Central France. The members of this order are found in later Permian rocks in other countries of the North, and in still later rocks in outlying countries, as shown in Chart II. One family is limited to Brazil and South Africa; the two genera allotted to this family (one in each country) appear to be similar. After the Lower Eocene period in France, Belgium and the United States, they are no longer found fossil, but they have a living representative in some islands off New Zealand in the lizard, Tuatera (*Hatteria*), specimens of which are to be seen in the Zoological Gardens.

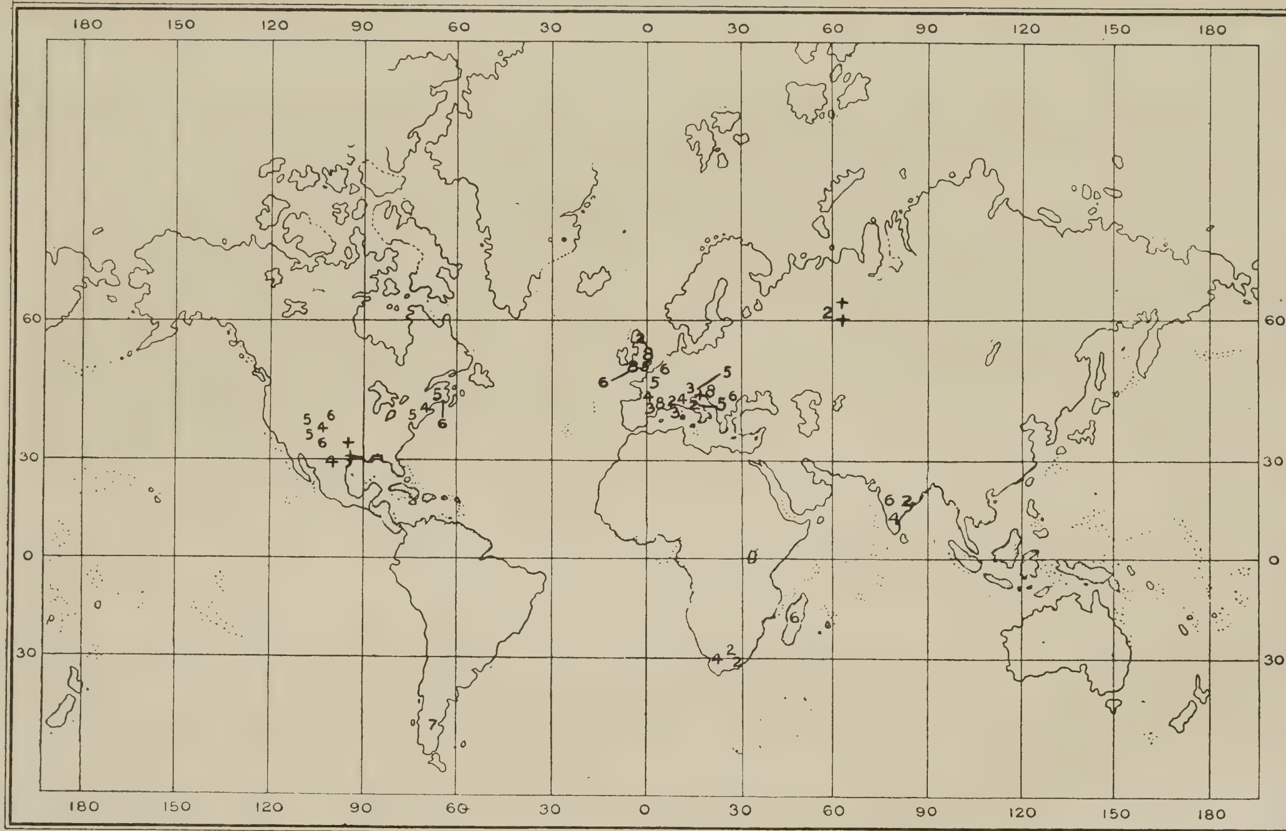
Another order of the Reptiles appeared in the Permian period. This order may be called "Beast-like," as it occupies an anatomical position between the labyrinthine-toothed *Amphibia* and the lowest mammals. It will be remembered that the *Amphibia* with this special characteristic appeared in the Triassic period, that is, some time after the advent of the Beast-like reptiles; but the teeth of some of the earlier *Amphibia* showed an infolding of the dentine, which has been taken as an early stage of the labyrinthine structure, and as an index of their community of characteristics.

Chart III shows the distribution of the Beast-like Reptiles. They evidently originated on the ancient northern continent, their remains being buried in the Permian of Texas, Würtemburg and Russia. Thence they spread to South Africa and Peninsular India. The South African forms were numerous and varied, some being of the same genera as specimens found in Scotland, Russia and India, others being forms not found elsewhere. Their presence in South Africa in great profusion without intermediate forms between them and the two families of *Amphibia*, and one of the earlier Reptiles found in that country, indicates that they did not originate there.

These Beast-like Reptiles show so great a variety of forms that we must note their distribution in greater detail than has been done with other orders. The first suborder contains two families originating in, and confined to, the Permian of Texas, and one family found first in the Permian of Saxony, and later in Scotland, Switzerland, Russia and South Africa. One genus living in the two latter countries was the same.

In the second suborder, called the "Dog-toothed," the South African Triassic families are different from those found in the Permian of Russia, the only other country where this suborder has been found, excepting some teeth in the Upper Trias in Ger-

CHART III.



Time and Place Distribution of
- Beast-like Reptiles: +—Permian. 2.—Trias. 3.—Marine Trias.
- Dinosaurs: 4.—Trias. 5.—Jurassic. 6.—Cretaceous. 7.—Miocene.
- Winged Reptiles: 8.—Lower Jurassic. 9.—Upper Jurassic. 10.—Cretaceous.

many. The time-origin indicates that this suborder originated in the North, and differentiated as it extended South.

A third suborder, the members of which possessed teeth of anomalous arrangement, occurs only in the Trias of Scotland, Russia (Ural Mountains), South Africa and India. No complete forms of this order have been found; but one genus, found plentifully in the Karoo, occurs also in all the other countries just named.

A fourth suborder, a marine form with plates instead of teeth, is found only in France, Southern Germany, and the Alps.

This distribution is interesting from our present point of view, in that it indicates a northern locality as the station of origin of the order, whence offshoots spread in the first place to Texas and Europe. From Europe, the Scottish families spread southwards, by a route possibly to the west of Spain. There is no physical evidence, however, of continuity of the continents on the western side of the Mediterranean. Some of the Russian families went south through Asia Minor, or across the east of the modern Mediterranean, to South Africa and India. We may consequently anticipate that their remains may some day be found in such of the sandstones of Abyssinia and other parts of Africa as may be of Triassic or somewhat later date.

The next terrestrial reptilian order which appeared is that of the Dinosaurs. The lowest Triassic rocks of Würtemburg and the Trias of Connecticut have furnished the earliest complete remains of these animals, imperfect specimens of which have been found in the Trias of France, Bristol, Peninsular India, and the African Karoo. The remains are those of genera allied to that found in Würtemburg. No later forms are found in South Africa, but in England, Europe, and the Western United States they underwent in later times an immense development in numbers and varieties, and in the enormous size attained by individuals. In Cretaceous times Dinosaurs are found also in India and Madagascar; in Patagonia they occur in Miocene beds. The anatomical characters of Dinosaurs indicate alliance with Amphibia, Crocodiles and the Beast-like Reptiles. Their dentition shows them to have consisted of a carnivorous section and an herbivorous section, the former being the earliest Triassic forms, the others later in date.

The Crocodiles first appear in the Trias of Elgin, Central Germany, Alps, and the Western United States. In India they appear in the Lower Jurassic. They have continued right on to the present day, when they are found as Gavials in India, Crocodiles in all tropical rivers, and Alligators in America and China. The

genus *Crocodilus*, now so widely distributed, first appeared in the Cretaceous of Europe.

In the Triassic period two orders of aquatic reptiles appeared. The first, called Ichthyosaurs, or fish-lizards, were marine forms, breathing by means of lungs. Fragmentary remains of Ichthyosaurs have been recovered from the Lower Trias of Würtemburg and the Middle Trias of Nevada. The earliest typical forms are from the Upper Trias of Lombardy and Northern California. In the next period, the Jurassic, they are found in England, France, Germany and Wyoming. The genus *Ichythyosaurus* is first found in the bottom of the Jurassic beds in Dorsetshire, and other parts of England. It spread to Northern France, Würtemburg and Franconia; it continued in England till the end of the Cretaceous, during which period it appeared in New Zealand, Australia, India and Chili. Bearing in mind that this is a marine reptile, whose origin was in the vicinity of the Northern Continent shown in Chart I, its extension in the Cretaceous period to the Indian Ocean is an index of a vast change in the distribution of land and water in the latter period. The sea then covered the modern Sahara. This illustrates the truth that the appearance of orders and even families of animals in any locality with which we are familar is dependent upon dispersal through a congenial medium, and not to origination in every site where found.

The other aquatic order comprised long-necked sea-lizards, which may be exemplified by the well-known genus *Plesiosaurus*. These sea-lizards first appeared in the Trias of Germany, whence they spread to Switzerland, France, England, Russia, India and the United States, reaching New Zealand in Cretaceous times, that is, after the land-barrier between the North Atlantic and the Indian Ocean had broken down.

The period called Jurassic succeeded the Trias, and brought with it the winged reptiles. Their first appearance was at the bottom of the Jurassic rocks of Dorsetshire, whence they spread to Central France, Würtemburg, Bavaria, and the west of the United States, That is to say, they were buried in the deposits which now constitute those countries. This order presents us with a complete novelty in the means of locomotion; it is remarkable for its sudden appearance with completely developed arrangements for flight. Each fore-limb was furnished with an elongated digit, on the ulnar aspect, arranged for the support of a membranous wing. The bones were hollow. It will be observed that the distribution of the winged reptiles was very limited, being confined entirely to the Northern

Atlantic Continent. So far as is known they disappeared before the end of the Cretaceous period.

The group of toothless reptiles, which includes the tortoises, is first found in the upper portion of the Trias of Würtemburg. The earliest members are fully developed forms of their order, and their successors have not shown any essential change of structure. They are found next in the Upper Jurassic of other parts of Germany, in France (North), England, and the United States, extending subsequently to other countries in later periods (India, Australia, New Zealand).

There is yet another order, the scaly reptiles, which embraces the lizards and the snakes. But besides the latter there were two marine forms of this order ; one, confined to the Cretaceous period, was found in England and on the eastern shores of the Adriatic. The other marine suborder, possessing like the last, two pairs of paddles, bore a strong resemblance to whales as regards the body. Its members had lizard-like heads. Their fossils are confined to the upper Chalk of Belgium, Holland, North Germany, France, and the United States.

The Lizards are first found at the top of the Jurassic in England, but the remains here and elsewhere are fragmentary. They occur in France, Germany, Wyoming and Colorado in Tertiary deposits. Two genera gigantic in form have been found in Pleistocene deposits in Queensland. The family to which belongs the well-known Iguana of America appeared first in the Tertiary rocks of Europe.

Snakes are first found as complete skeletons in certain deposits of the Miocene age of Switzerland, Greece and Germany ; detached snake-like vertebræ have been found earlier than this (Eocene) in England, France, Switzerland, New Jersey, Wyoming and New Mexico, Colorado and Oregon. All the fossil forms are much the same as those of the present day.

Abbreviated as is the above sketch of the Reptiles, sufficient has been mentioned to indicate that the class first appeared on the Northern Atlantic Continent, on the fringe of which, whether in modern America or modern Europe, the different orders were buried at periods which were for each order approximately contemporaneous, and that they required time and favourable physical conditions to enable them to reach lands more distant.

Although the Birds are more independent of breaks in the continuity of land, yet the same central origin is apparent from the study of their geological distribution.

Owing to the want of variation in the endoskeletal arrangements of birds as compared with the numerous variations in their colours and plumage, their fossil remains do not provide us with the immense variety apparent in the present day. Another fact militates against the completeness of the record we are searching for, and that is the comparative rarity with which their forms have been preserved. Several causes have been assigned for this; perhaps one potent cause may be the large amount of lime contained in their bones; this being easily washed out, would lead to the crumbling and disappearance of the skeleton. But we have sufficient to show the first appearance of birds in the northern continent and their subsequent spread to the south.

The earliest known bird occurs in the Upper Jurassic strata of Solenhofen in Germany. Its main difference from modern birds consists in its having teeth, and further in its probably not possessing a beak, as it has teeth in the pre-maxillæ. Its vertebræ are prolonged into a remarkably lengthy tail. The bones are not hollowed for air.

This ancient bird is succeeded after an interval by the "Toothed Birds"; among the earliest forms of these are some which have no wing, the fore-limb being represented by a rudimentary humerus. The foot is four-toed, the outer digit being of great length. They occur in the Cretaceous (upper) of Kansas. A member of the same order is found in the lowest Cretaceous of Cambridge, England. Some of the toothed birds possessed wings; a further distinction among these is that their teeth were placed each in a socket, instead of being arranged in a groove, as was the case with the wingless forms. This form is also found in the Cretaceous of Kansas.

Probably descended from the above toothed birds are the flightless birds. These, in the south, follow a course analogous to that we have seen obtaining with the Reptiles when they reached the final stage of their existence, namely, enormous size and anomalous development.

A bird which though not toothed, has serrations of the margins of the jaws, perhaps belongs to the same order as gannets, and occurs in the Lower Eocene of England.

But in the Cretaceous period the modern birds were appearing. Thus we find a member of the order to which belong ducks and flamingoes in the Cretaceous of Sweden. This order then appears in the Eocene of France, whence it spreads through Europe, a member arriving in New Zealand in the Pleistocene period. With the exceptions noted the various orders of modern birds are first

CHART IV.

TIME AND PLACE DISTRIBUTION OF

The Birds
- +—Upper Jurassic.
- 2.—Cretaceous.
- 3.—Eocene.
- 4.—Miocene.
- 5.—Pliocene.
- 6.—Pleistocene.

Flightless Birds
- 7.—Eocene.
- 8.—Lower Pliocene.
- 9.—Upper Pliocene.
- 10.—Pleistocene.
- o.—Recent.

found in the Eocene and Miocene of Europe, France being especially rich in their remains, while Wyoming also possesses a liberal supply of forms of the same period.

Many of these forms have been driven out of Europe. Some have, through the agency of man, since returned; for instance the pheasant, which has been introduced into Europe from Asia, is found fossil in the Miocene of France.

A glance at Chart IV. will show the dispersion of the Birds. It may be noted here that the birds of the so-called Eocene of Patagonia and New Zealand belong to the Penguins.

(*To be concluded.*)

Reprint.

FOURTH ANNUAL REPORT OF THE PASTEUR INSTITUTE OF INDIA, KASAULI, FROM AUGUST 9TH, 1903, TO AUGUST 8TH, 1904.

By Lieutenant-Colonel D. SEMPLE.

Royal Army Medical Corps.

Director of the Institute.

I.—Statistical Summary.

During the year under review 612 persons bitten by dogs, jackals, and other animals, believed to be rabid, underwent a course of preventive treatment against hydrophobia. Of this number 248 were Europeans and 364 Natives.

The numbers treated yearly since the Institute was opened on August 9th, 1900, are:—

1st year..	321
2nd ,, ...	543
3rd ,, ...	584
4th ,, ...	612

These figures do not include a large number of persons who came for advice as to whether treatment was necessary, and in whose cases it was found that treatment was not required. Some fifty persons came under this heading during the past year alone.

Following the general rule adopted in previous years, and in the statistics of other anti-rabic institutes, the patients treated were divided into three classes:—

Class A.—Those bitten by animals proved to have had rabies, either by an experiment with a portion of their brain or spinal cord, or by the development of the disease in other persons, or other animals bitten by them.

Class B.—Those bitten by animals certified rabid by a veterinary surgeon or by a medical officer, after examination, before or after death, or both.

Class C.—Those bitten by animals in which there were very good reasons to suspect rabies.

Each of these classes is again divided into three subclasses:—

Sub-Class I.—Those bitten on the head or face.

Sub-Class II.—Those bitten through the exposed skin on any part of the body other than the head or face.

Sub-Class III.—Those bitten through the clothing.

The object of a classification made on these lines is to arrive at some idea as to the danger and severity of the cases.

Bites on the head or face are more dangerous than bites anywhere else. Bites on the bare skin are more dangerous than bites through clothing, because in the latter case the clothing serves to wipe off some

of the virus from the animal's teeth. In this country bites on the bare skin are the rule as regards Natives, but in colder countries, and with Europeans in India, the hands are the only parts of the body exposed other than the head and face.

A Native bitten through a single layer of a thin cotton garment certainly receives more virus than a European bitten through a better class of garment. The question of clothing alone is a factor which renders bites from rabid animals, taken as a whole, more dangerous to the natives of warm climates than to Europeans, or to the Natives of European climates. The most important factor of all connected with anti-rabic treatment is that it should be commenced at the earliest possible date after infection. It will be seen from what follows that this is not appreciated in India as it should be.

The numbers in the different classes and sub-classes, together with the failures after treatment in each division, are given in Table I., which includes all those treated during the year. In Tables II. and III. the Europeans and Natives are given separately. Tables IV., V. and VI. require no further explanation.

TABLE I.—*Statistical Table for all cases.*

Classes	Sub-Class I. Bitten on the head or face			Sub-Class II. Bitten through the exposed skin on any part of the body other than the head or face			Sub-Class III. Bitten through the clothing			Totals		
	Treated	Failures	Percentage of failures	Treated	Failures	Percentage of failures	Treated	Failures	Percentage of failures	Treated	Failures	Percentage of failures
Class A.—Bitten by animals proved rabid	10	0	0	113	0	0	25	0	0	148	0	0
Class B.—Bitten by animals certified rabid	6	0	0	50	0	0	9	0	0	65	0	0
Class C.—Bitten by animals suspected rabid... ...	11	0	0	319	5	1·56	69	0	0	399	5	1·25
Total ...	27	0	0	482	5	1·03	103	0	0	612	5	0·81

The average length of time which elapsed between the infliction of the bites and commencement of treatment in the total numbers treated was 9·8 days.

Out of a total of 612 persons treated, there were 5 cases in which the treatment failed to confer protection.

These 5 persons (all Natives) contracted hydrophobia more than fourteen days after the completion of treatment. All were deeply and severely bitten, and the bites were numerous and inflicted on the bare person, and with one exception they arrived late for treatment.

In addition to the 5 cases in which treatment failed, 3 patients developed hydrophobia during treatment, and 2 others within a period of fourteen days after the completion of treatment. These 5 cases (all Natives) cannot be looked upon as cases in which the treatment failed,

owing to the fact that their nerve centres became invaded by the virus of the animals which inflicted the bites before it was possible to render them immune against the disease; or, in other words, the object of the treatment was defeated in these cases before it was possible to have it carried out.

The reasons for eliminating cases of this class as failures are based on the information derived from experimental rabies on animals.

TABLE II.—*European Statistical Table.*

Classes	Sub-Class I. Bitten on the head or face			Sub-Class II. Bitten through the exposed skin on any part of the body other than the head or face			Sub-Class III. Bitten through the clothing			Totals		
	Treated	Failures	Percentage of failures	Treated	Failures	Percentage of failures	Treated	Failures	Percentage of failures	Treated	Failures	Percentage of failures
Class A.—Bitten by animals proved rabid	6	0	0	64	0	0	17	0	0	87	0	0
Class B.—Bitten by animals certified rabid	6	0	0	34	0	0	6	0	0	46	0	0
Class C.—Bitten by animals suspected rabid	3	0	0	77	0	0	35	0	0	115	0	0
Total ...	15	0	0	175	0	0	58	0	0	248	0	0

The average length of time which elapsed between the infliction of the bites and commencement of treatment in these cases was 7·2 days.

TABLE III.—*Native Statistical Table.*

Classes	Sub-Class I. Bitten on the head or face			Sub-Class II. Bitten through the exposed skin on any part of the body other than the head or face			Sub-Class III. Bitten through the clothing			Totals		
	Treated	Failures	Percentage of failures	Treated	Failures	Percentage of failures	Treated	Failures	Percentage of failures	Treated	Failures	Percentage of failures
Class A.—Bitten by animals proved rabid	4	0	0	49	0	0	8	0	0	61	0	0
Class B.—Bitten by animals certified rabid	0	0	0	16	0	0	3	0	0	19	0	0
Class C.—Bitten by animals suspected rabid	8	0	0	242	5	2·05	34	0	0	284	5	1·76
Total ...	12	0	0	307	5	1·62	45	0	0	364	5	1·37

The average length of time which elapsed between the infliction of the bites and commencement of treatment in these cases was 11·6 days.

Total Number of Europeans Treated during the Year.

Men	197
Women	24
Children	27
	248

Total Number of Natives Treated during the Year.

Men	282
Women	21
Children	61
	364

As regards the classes of the population from which the patients were derived, the numbers are:—

I.—*British Army.*

Officers	12
Ladies	6
Warrant Officers	4
British soldiers	119
Soldiers' wives	3
Soldiers' children	9
	153

Of these 153 patients, 51 were bitten by animals proved rabid, 22 by animals certified rabid, and 80 by animals suspected rabid.

II.—*Indian Army.*

British Officers	13
Officers' wives	2
Sepoys	32
	47

Of these 47 patients, 13 were bitten by animals proved rabid, 4 by animals certified rabid, and 30 by animals suspected rabid.

III.—*European Civilians.*

European civilians	80

Of these 80 patients, 27 were bitten by animals proved rabid, 20 by animals certified rabid, and 33 by animals suspected rabid.

IV.—*Native Civilians.*

Native civilians	332

Of these 332 patients, 58 were bitten by animals proved rabid, 19 by animals certified rabid, and 255 by animals suspected rabid.

Of the European civilians, 11 were Government servants, and of the Native civilians, 62 were in Government employment of some kind.

It will be noticed that the average time which elapsed between the infliction of the bites and commencement of treatment for the total number of cases treated, viz., 9·8 days, is rather long. In many of the cases it was necessary to hasten the treatment as much as possible, either by the intensive method, or a modification of it, so as to catch up lost time.

In the majority of cases the Natives arrived later than the Europeans. The average time which elapsed between the infliction of the bites and commencement of treatment in the case of Europeans works out at 7·2 days, and in the case of Natives to 11·6 days; so that Europeans came for treatment on an average 4·4 days earlier than Natives.

Table II. which gives the European statistics for the year, could not be improved upon as regards results. Of the 248 cases treated every one proved successful; and of these 87 were bitten by animals proved rabid, 46 by animals certified rabid, and 115 by animals suspected rabid.

Table III., which gives the Native statistics for the year, is also very good when we take into consideration the facts connected with most of the cases. The majority were very severely bitten, and many of them arrived with their wounds neglected and suppurating. Others were too poor to afford to diet themselves liberally during treatment, because they had spent most of their money on the railway journey, and had very little left for food during their stay in Kasauli.

A patient undergoing treatment should have a liberal diet, but it is difficult to enforce this in the case of a poor Native, when he tells you that he requires all his money for his railway fare. In some cases it was a matter of feeding them and paying their railway journey from the funds of the Institute.

Generally speaking, the majority of Natives arrive later for treatment than Europeans, with a worse class of wounds, seldom cauterised in time to do any good, and often neglected and suppurating. It must be recognised that these are factors which render treatment more difficult.

There were 44 of the Native cases due to jackal bites, and all had to be treated either by the intensive method or a modification of it. There were no casualties amongst this lot. Twenty-eight of the worst cases out of the 44 received preliminary treatment with anti-rabic serum. Although these 44 cases are returned in Class C, it may be taken for granted that the jackals were rabid and that in reality they belonged to Class A.

A jackal never attacks anyone unless he is suffering from rabies. Their bites are on a par with wolf-bites, and untreated give rise to a higher mortality than dog-bites.

The animals which inflicted the bites were :—

Dogs	545 cases.
Jackals	44 ,,
Horses	10 ,,
Cats	4 ,,
Mule	1 case.
Monkey	1 ,,
Bear	1 ,,
Wolf	1 ,,
Donkey	1 ,,
Rabbit	1 ,

In addition 3 cases were infected by the saliva of a man suffering from hydrophobia.

TABLE IV.—*Showing the Numbers who came for Treatment each Month during the Year.*

Month.	Europeans.	Natives.	Totals.
1903.			
August 9 to 31	22	41	63
September	14	34	48
October	14	30	44
November	13	25	38
December	19	28	47
1904.			
January	20	24	44
February	21	17	38
March	25	33	58
April	17	26	43
May	25	39	64
June	22	24	46
July	27	37	64
August 1 to 8	9	6	15
Total ...	248	364	612

TABLE V.—*Total Number of Patients treated from August* 9*th*, 1903, *to August* 8*th*, 1904, *according to the Provinces from which they came.*

Provinces.	Europeans.	Natives.	Total.
Punjab	68	122	190
United Provinces	41	86	127
Bengal	25	29	54
Bombay	27	40	67
Madras	33	20	53
Central Provinces	8	26	34
Burma	21	6	27
North-West Frontier Province	18	13	31
Assam	2	10	12
Rajputana	3	4	7
Kashmir	2	8	10
Total ...	248	364	612

TABLE VI.—*Classification of Native Patients treated from August* 9*th*, 1903, *to August* 8*th*, 1904, *according to Castes.*

Muhammadans						Hindus													Other Religions			
Sheikhs	Pathans	Mughals	Syads	Other castes	Total	Brahmins	Khatris	Banias	Sikhs	Kaisths	Rajputs	Thakurs	Jats	Lalbegi	Kahars	Marhattahs	Other castes	Total	Burmese	Parsees	Native Christians	Grand Total
38	18	4	7	34	101	45	11	5	22	4	4	3	5	28	9	2	98	236	1	3	23	364

II.—The Importance of Early Treatment.

No point connected with anti-rabic treatment is of more importance than its commencement at the earliest possible moment after being bitten by a rabid animal.

It is difficult to get the public to grasp the importance of this fact. When patients come early treatment is lighter, can be completed in a shorter time, and success is more certain. Persons bitten on the head, face or neck should be under treatment by the third day, and those bitten on any other part of the body by the fifth day. When more time is wasted at the outset the case must be looked upon as late, and the chances of success less certain. In late cases it is often necessary to increase the number of the inoculations at the outset so as to catch up lost time. This is the rule in head and face cases, whether they come late or early, but during the past year it was necessary to apply it in a great many cases bitten on other parts of the body on account of late arrivals.

It is not an unusual thing for railway, postal and telegraph employees, also Native policemen, to waste days, and sometimes weeks, in obtaining official sanction before setting out for treatment, or, on the other hand, to waste an equally lengthy period of time in hospital, waiting for their wounds to heal up. When there is good reason to suspect that the animals which inflicted the bites were rabid, the advice should be "come at once, and obtain sanction afterwards, and have your wounds attended to at the Institute where treatment is carried out." In cases of this kind, any local official (acting on medical advice) should be empowered to allow the person bitten to leave for treatment, or to obtain telegraphic sanction from a higher authority. Every European and Native official in India ought to know the value of time in treatment in any accident where danger to life is involved; and I think most people are ready to acknowledge that the bite from a rabid animal is a case in point.

I cannot illustrate what ought to be done better than by quoting a case which came under my notice some time ago.

An officer in the United Provinces was severely bitten on the face by a dog which showed unmistakable signs of rabies. He at once sought the advice of a medical officer, and his advice (after cauterising the wounds) was, "proceed to Kasauli by the first available train, and obtain leave afterwards." He acted on this advice, and was under treatment within twenty-four hours from the time he was bitten. The dog was subsequently destroyed, and a small portion of his brain sent in a small bottle of sterile neutral glycerine. An animal inoculated with a portion of the brain sent, subsequently developed typical rabies, which conclusively proved that the dog was rabid. This is only one out of a number of other cases which were treated under similar circumstances. It would be very easy to give many examples in which the course pursued was very different from the case quoted.

III.—Treatment with Anti-Rabic Serum.

During the year under review 202 cases received preliminary treatment with anti-rabic serum. The details of the preparation of this serum were given in last year's report.

The average amount of serum used in these cases was 10 cc., and this amount was given hypodermically on the day when they first pre-

sented themselves for treatment, and next day the usual treatment, commencing with virus attenuated for fourteen days, was carried out. These cases were selected either because they came late for treatment, or were severely bitten and under circumstances which left little or no doubt but that the animals which inflicted the bites suffered from rabies. For theoretical reasons it was not deemed advisable as a rule to administer a larger dose than 10 cc. Of the 202 cases treated in this way three were failures; and one (a patient severely bitten on the face by a wolf) contracted hydrophobia during treatment, and one within fourteen days after the completion of treatment. All these cases are included in the statistics already given.

Owing to the fact that serum treatment was followed by the ordinary treatment, it is difficult to say whether any real benefit was derived from the use of the serum.

In a number of the worst cases of all, the serum was injected into and around the wounds, and none of these proved failures; but here, again, the treatment which followed the serum might have been all that was required to save them. The subject still requires further investigation.

The anti-rabic serum used was prepared at the Institute. It is the serum of horses highly immunised against rabies, and is highly destructive to rabies virus when mixed with it *in vitro* (see report of third year). The average time which elapsed between the infliction of the bites and commencement of treatment in the cases which received serum was 10·3 days.

IV.—Suggestions and Recommendations for the Prevention of the Spread of Rabies in Indian Cantonments and Municipalities.

In the foregoing statistics it will be seen that out of a total of 612 persons treated during the year, 545 were bitten by dogs. This gives 89 per cent. of the cases due to dog-bites, and of these, by far the greater majority were bitten by ownerless animals.

The next largest number, viz., 44 cases out of 612 treated, were bitten by jackals. This gives a little under 7·2 per cent. due to jackal-bites.

As far as we know, rabies is only spread by an animal suffering from the disease, communicating it to another animal, and in nearly every case the method of communication is by a bite. All warm-blooded animals are susceptible to rabies, but dogs, jackals and wolves, from the nature of their habits, are better suited to convey the disease to man than other animals are. To rid India of dogs, jackals and wolves would go a very long way towards freeing the country from rabies, but this would be an almost impossible undertaking, and for several reasons it might not be desirable to attempt it. From a practical point of view, the only reasonable thing to attempt in this direction would be to diminish the number of ownerless and half-starved pariah dogs in the vicinity of cantonments and European settlements, or wherever they were found to be numerous and uncared for.

It would be almost useless to attempt the extirpation of jackals in a country where they are so numerous. The chances are that there are always cases of rabies amongst jackals, and that these animals infect pariah dogs, and these in their turn bite other dogs and human beings. The pariah dogs are the animals responsible for infecting the majority of Natives bitten, and also for infecting numbers of European dogs and

Europeans in India. Jackals are also responsible in the same way, but to a minor extent.

A moderate tax on dogs all over the country, and the destruction of those which did not belong to any one in particular, would help to diminish the prevalence of rabies in this country.

There would be no difficulty in having this carried out in cantonments and other European centres, but in district villages and other out-of-the-way places the problem is not quite so easy. No doubt the tax alone would lead to the diminution of useless animals.

In European countries dogs are under legislative control, and there is no reason why a similar system should not work well in India. Legislative control and taxation would be a practical method of diminishing what is at present a public danger.

V.—Remarks on the Working of the Institute during the Year.

(1) *Accommodation for Patients.*—The present system for the accommodation of patients works most satisfactorily.

There is only one class of patients for which the accommodation might be improved, and that is in the case of well-to-do Natives. All other classes are amply provided for.

(*a*) British soldiers are accommodated in the Station Hospital. Here they are under control as regards their diet, drink and exercise, most important factors in the treatment.

(*b*) Native soldiers, Native policemen, and the poorer class of Native patients generally, are accommodated in houses built for the purpose, and within a few minutes' walk from the Institute. They are given these quarters free, and they are also given the use of warm clothing, blankets and cooking utensils, should they require them. Khan Bahadur C. Dhanjibhoy, C.I.E., Rawalpindi, has very generously and at his own expense renewed his former supply of blankets and warm clothing for the purpose here indicated. A *bania* lives in the same compound and sells them whatever they want in the way of food and at bazaar rates. This man is under control of the Institute.

(*c*) The poorer class of European and Eurasian patients, who cannot afford to live at hotels, are accommodated in a large bungalow belonging to the Institute, and only a short distance from it. This bungalow is run on lines somewhat similar to a *dâk* bungalow, but much cheaper. It is well furnished and comfortable. Rent is charged at the rate of 4 annas a day, and a liberal diet is provided at Rs. 2-4-0 a day, including attendance.

(*d*) Well-to-do Europeans live in hotels, or make whatever other arrangements they think best.

(*e*) Well-to-do Natives have some difficulty in finding suitable accommodation. They are obliged to hire a house in the bazaar, and suitable houses are not always easy to find. What is required in their case is an ordinary bungalow in the vicinity of the Institute, specially set apart for the purpose. The solution of this difficulty is a matter for the consideration of grateful and well-to-do Native patients.

It could hardly be expected of a charitable institute, where treatment is given free to all comers, to extend its charity as regards free quarters to those who are very well off.

(2) There were no climate difficulties during the past year which required anything more than ordinary attention to keep things right.

(3) A gas installation apparatus was purchased during the past year. It is now in full working order, and meets a want which has been badly felt ever since the Institute was opened.

(4) The equipment of the laboratory has been recently added to, and brought up to date as regards improvement in apparatus, &c. This also meets a want which has been felt for some time.

(5) The Institute building has also been added to, and considerably improved during the year.

(6) The conduct of the patients during treatment has been all that could be desired. In no single instance has there been the least trouble in their management. Civilian patients, although absolutely free agents to leave when they like, have never done so before being told that their treatment was completed, except in the case of one man, who returned home on account of some domestic difficulties.

Considering that the treatment lasts on an average about twenty days, the fact of Native patients of all classes patiently waiting until it is completed, is proof enough that they appreciate and give their attention to what is being done for them.

(7) None of the patients were ill from the effects of treatment. They were able to go about as usual and without inconvenience.

VI.—Summary of Work done during the Year in Addition to Anti-Rabic Treatment.

In addition to anti-rabic treatment a considerable amount of general bacteriological work was carried out, also the preparation of a large amount of sera for therapeutical purposes.

Facilities and assistance were given to officers of the Royal Army Medical Corps and Indian Medical Service to work in the laboratory, to improve their knowledge of bacteriology and bacteriological *technique*, and to work up subjects in which they were interested. Twelve officers availed themselves of this privilege by spending their ordinary leave at work.

(1) The sera prepared at the Institute and issued free to Government Hospitals and Dispensaries during the year consisted of—

	Bottles.
(*a*) Anti-venomous serum	3,255
(*b*) Anti-tetanic serum	614
(*c*) Anti-diphtheritic serum	511

The market value of this amount of sera comes to Rs. 21,750, reckoning at the lowest estimation.

The preparation of anti-sera was undertaken with the view of meeting a long-felt want in India. In former years sera for use in this country had to be purchased at high prices in Europe; and owing to the difficulty of replacement on short notice, when used up, a large stock had to be always kept on hand.

To meet the large demand for sera all over India threw a great deal of extra work on the limited staff of the Institute. This work required constant care and attention in immunising and bleeding horses, testing, standardising and sending out the sera aseptically.

The anti-venene issued during the year was prepared by immunising horses with cobra venom, and is specific for cobra poisoning only. Two other kinds of anti-venene have now been prepared, viz., one by

immunising horses with *Daboia russelli* venom, and another by using a mixture of daboia and cobra venom. At present these are being tested and standardised.

(2) Bacteriological examinations, serum diagnosis, &c., were carried out in 583 cases. Specimens for examinations were received from all parts of India, and in every case as thorough an examination as possible was made and the results communicated to the medical officers who sent them.

This is a class of work which should be undertaken and carried out on the spot by the medical officers who treat the cases. With few exceptions, there should be no necessity to send ordinary clinical specimens anywhere for examination. The necessity for work of this kind being carried out at a special laboratory, or at a distance from the patient, should disappear when a better knowledge of the ease with which it can be accomplished by any one who possesses a microscope and has an elementary knowledge of bacteriological *technique* becomes known. The examinations included:—

(*a*) Serum diagnosis for typhoid and Malta fever in 310 cases.

(*b*) Examination of pathological material for tubercle in 65 cases.

(*c*) Examination of material for plague bacilli in 14 cases.

(*d*) Cultural examination for diphtheria bacilli in 6 cases.

(*e*) Examination of specimens for anthrax in 6 cases.

(*f*) Miscellaneous examinations and diagnosis from material sent to the laboratory in 65 cases.

(3) In 154 cases an experimental diagnosis was made in connection with suspected rabies in animals. In nearly all these cases the animals suspected had bitten either human beings or domestic animals, and it was most important to arrive at a correct conclusion as to whether they suffered from rabies or not. To repeat what I have said in other reports, the material, which should be sent for diagnostic purposes from a suspected rabid animal, is a small portion of either the brain or spinal cord, removed aseptically, and put into a small bottle of sterile neutral glycerine, well corked, sealed, and securely packed in a strong box. During the hot weather months, when the temperature in the shade is over 90° F., the bottle should be packed in ice, but this is not necessary when the temperature is below 90° F. Medical officers and veterinary surgeons in India ought to make themselves acquainted with these elementary details; if they did, fewer specimens of this kind would arrive useless for experimental purposes.

(4) A considerable amount of research work in connection with the preparation of curative sera, anti-rabic treatment, cerebrospinal meningitis, and the action of snake venoms was carried out during the year. In this field of research Captain G. Lamb, I.M.S., has done most excellent work in clearing up the physiological action of snake venoms, and establishing the specificity of the sera prepared by their use.

In conclusion, I wish to tender my best thanks to Captain G. Lamb, I.M.S., Captain W. F. Harvey, I.M.S., and Assistant Surgeon C. J. Fox, for their able assistance. Captain Lamb (Assistant Director) directed the work of the Institute for three months during my absence in England, and was then assisted by Captain Harvey. Mr. Fox has invariably carried out with tact and care the many trying duties entrusted to him. My thanks are also due to Hospital Assistant Nanak Chand, for much useful help.

Reviews.

THE REPORT ON THE MEDICAL ARRANGEMENTS IN THE SOUTH AFRICAN WAR WITH REGARD TO THE AUXILIARY MEDICAL SERVICES.

The Report brings to notice some highly interesting and instructive matter in connection with the Auxiliary Medical Services generally.

The deficiency of the *personnel* in knowledge of hospital duties is emphasised throughout, and it would appear better things were expected of it. This was probably due to the fact that the opportunities for training in such duties in peace was over-estimated. No doubt if it had been realised how scanty these opportunities are, particularly for obtaining an adequate training in nursing work, the expectation would have been less. When it is remembered that in the case of the Militia Medical Corps only twenty working days a year are available for instruction in all Corps duties, it will be seen how brief in the aggregate is the time that can be actually devoted to learning practical nursing in hospital. In every branch of the Auxiliary Medical Services, the instruction must of necessity be chiefly theoretical and disjointed, conditions which do not tend to produce skill in nursing. The conclusion arrived at that the training must be more thorough or the *personnel* employed in more elementary duties in future, seems only fair and reasonable. Unfortunately, numerous circumstances combine to make a material extension of the instructional period impracticable, and it is not obvious how greater facilities for practical instruction in nursing could be obtained.

At the moment, however, the most interesting subject in the Report is the recommendation that the Auxiliary Forces should be provided with field medical units. This is, in so far as the Militia is concerned, a matter of supreme importance at the present juncture, when the intention is to make the Force liable for service abroad in certain circumstances. At the inception of the Auxiliary Medical Services, presumably it was intended that an organised connection should exist between them and the Auxiliary Forces, but in the case of the Militia this does not at present obtain. Under former conditions of service there may not have been the same necessity for establishing this connection which now exists, but in view of the intended liability for service abroad, it seems politic to provide for the medical care both of regimental and larger units of Militia. Unless a medical organisation is given the Force, an additional strain will be put on the Royal Army Medical Corps on the outbreak of war. With little difficulty this risk could be avoided, for the existing Militia Medical Corps could very well supply the field medical units the Force requires. The Report advises the provision of "field ambulances" for the Auxiliary Forces, and it is evident from the Report that this is the kind of medical unit which the Auxiliary Medical Services, more especially the Militia, can best be trained to serve. Not only is this so, but the "field ambulance" is the form of medical unit most suited to the particular requirements of the Militia, and would ensure in the greatest

degree at all times adequate medical aid for the Force without calling on the Royal Army Medical Corps for assistance.

Such a service admittedly would not make provision for the medical care of regimental units, which is a matter of importance, since in all probability regimental rather than larger units of Militia would be employed for reinforcement on active service; but this is a detail that could be provided by appointing medical officers direct to such charges. Possibly the existing lines of organisation do not best fit the Militia Medical Corps for meeting the requirements of the Militia in its new *rôle*, though no very radical change would be necessary to enable it to meet the altered conditions of the Force. It would facilitate matters considerably if the "field ambulance" was made the unit of the Corps, instead of retaining the present company basis, the number and distribution of the former being made according to the requirements of Militia in the several Commands. Suitable centres for headquarters for these units could be selected by Principal Medical Officers in their Commands, the facilities for recruiting being kept in view, and it would be a great advantage if recruits were trained locally. An arrangement of this kind would give Principal Medical Officers the necessary full control over the "field ambulances" in their Commands, which would enable them to detail them or their component sections for combined training with other arms in peace, and make all arrangements for their mobilisation and disposition in the event of war. Possibly expense would limit the pattern and scale of field medical units for Militia, particularly in the matter of *matériel;* probably if a section, or at most half a "field ambulance," was provided for each brigade, plus the regimental establishment (medical), it would generally suffice to meet all requirements. The methods here suggested may make it appear that the Militia Medical Corps would only be capable of indirectly reinforcing the Royal Army Medical Corps, but this is not so, in fact, they offer alternative methods of employment not possible under the existing system; for the "field ambulances" need not be indissolubly bound to Militia brigades, the *personnel* could be taken for direct reinforcement if the need be greater. The above-named Report makes clear where and how auxiliary medical aid can be most usefully employed; in the case of the Militia in particular, the suggested distribution would on these grounds be to the best advantage, and make the Force itself more ready for war.

J. H. P. Graham,
Captain Royal Army Medical Corps (Militia).

Climate and Health in Hot Countries. by Lieutenant-Colonel G. M. Giles, M.B., F.R.C.S., Indian Medical Service (retired). London: John Bale, Sons and Danielsson, Ltd. Price 7s. 6d. Part II. is published separately, price 5s.

This book is divided into four parts, the first of which deals with tropical hygiene, and the second with tropical climatology. In the first part the author has dealt in a broad and comprehensive way with the application of the principles of hygiene to the conditions of life in hot countries. Although intended mainly for the non-professional reader, this part of the book may also be read with advantage by the medical man who is called upon to practise his profession in the Tropics. Much

sound information is given regarding housing, clothing, water and food. In the chapter on "the tropical day" Lieutenant-Colonel Giles points out that while it is necessary to take measures to exclude heat during the hottest part of the day, yet care should be taken to admit as much light as possible; health can best be maintained in the hot season if a fair amount of exercise be taken, and if people will avoid, as far as practicable, shutting themselves up for all the daylight hours in stifling and depressing semi-darkness. There is a good chapter on the management of children; and in the next chapter many useful hints are given in connection with the construction of tents and camp sanitation. The subject of malaria is dealt with at considerable length; and there is also a very useful chapter on the prevention and treatment of the more common tropical diseases.

In the second part of this book an account is given of the climatic conditions of the various tropical parts of the world. From official meteorological and other sources, the author has gathered together a large mass of data, not hitherto easily accessible, which may be usefully consulted by those in search of special information regarding tropical climatology.

T. McCulloch.

Current Literature.

Spirillary Dysentery.—Dr. Le Dantec, Professor of Tropical Pathology at Bordeaux, claims to have discovered a form of dysentery due to the presence of spirilla in the large intestine (*Le Caducée*, December 17, 1904). The complaint is common in the south-west of France, and especially in the Bordeaux district. It is easily recognisable by microscopical examination of the mucous discharges, which may be regarded as pure cultures of the organism. A minute portion of the mucus (the greyish part) is treated with diluted ziehl, and spread out beneath a cover-glass, which is sealed with balsam. Masses of spirilla resembling minute hedgehogs are then seen, and sometimes cylindrical cells surmounted by caps of spirilla. Four or five of such cells may be joined together. It would seem that the disease is really a spirillary diphtheria of the large intestine. It is not accompanied by fever or hepatic complications. Treatment by bismuth, salol and tannin proves ineffectual; antiseptic injections continued for several weeks cure the disease.

These views are not accepted by MM. Troussaint and Simonin, who published (*Le Caducée*, May 7th, 1904) a case of dysentery which they considered to be due to a hæmatophagous parasite, resembling the ciliated infusoria. In a subsequent number of the same journal they state their objections at some length. Blood cells were recognisable within the vesicles of the parasite, and nothing could be detected that suggested the idea of altered epithelium. They failed to discover spirilla in the mucus; on the other hand, the absence of movement supported the view that the ciliated bodies were the remains of parasites. The granular cephalic disc of the protozoon was fixed by carmine; the vesicular body with double contour, was stained bright yellow by picric acid, and when mounted in glycerine with picro-carmine the parasites were completely deformed, owing to retraction of the contents. It is well known that spirilla are often found in the fæces of healthy persons. Under special circumstances they may rapidly increase in number, and acquire a temporary high degree of virulence. While admitting that dysentery may be thus caused, they suggest that Le Dantec's cases may be examples of symbiosis, the masses of spirilla masking, to some extent, those organisms which have really excited the disease.

T. P. Smith.

Wounds Caused by the Japanese Rifle, and Materials Used for Field-Dressings in the Russian Army in Manchuria.—Two letters on these subjects by Dr. Wreden, Principal Medical Officer of the Manchurian Army, are printed in the *D. Militärärztliche Zeitschrift* for January. In the first (May 31st, 1904) the Japanese rifle is described as a "humane" weapon, if such an epithet be permissible. Of course the severity of the injuries caused by the bullets depends upon the distance of the object and the nature of the injured tissues. Within 200

paces the hydrodynamic force of the bullet is very great. Wounds of the skull are fatal; long bones are severely shattered; the stomach and intestines are greatly damaged. The explosive force of the bullet ceases at from 400 to 800 paces. The wounded men usually do well, unless the abdominal organs are involved; bones and joints are simply perforated, and wounds of the lungs are seldom to be regarded as severe. Infection seldom occurs. At from 800 to 1,000 paces, the diaphyses and epiphyses of the bones are apt to be broken in pieces by the bullet; the apertures of entrance and exit are somewhat larger, and the wounds are not seldom infected by fragments of clothing. At over 1,000 paces the bullets remain in the body and do not usually damage the bones. As further proof of the "humanity" of the Japanese bullet, it may be mentioned that about a month after the battle of Türentschen 32 per cent. of all the wounded had returned to their duties.

Shells produce very different effects, viz., all kinds and degrees of laceration, with subsequent necrosis of tissues and profuse suppuration, inasmuch as foreign bodies of various kinds are driven into the wounds.

In his second letter (November 2nd, 1904) Wreden refers to the dressing-packets, which he regards as most valuable; no one goes into action without one. The materials can be very easily used both by officers and men; they are not aseptic, but antiseptic; neither hands nor wounds can be disinfected on the battlefield. Besides, in hot weather, when swarms of flies are everywhere, larvæ are soon developed in other dressings, whereas antiseptic materials prevent such development for at least twenty-four hours — a very important advantage. Wreden strongly recommends creasote; a 5 to 10 per cent. solution in ether, with which sterile wadding and gauze are saturated. No flies will settle on such a dressing. For profusely suppurating wounds he uses wadding saturated with tar. He complains of the size of the packets, a disadvantage which might be obviated by compression, as practised in Germany; the size can be thus reduced to one-third.

Wreden is satisfied with the instruments in use in the Russian hospitals; unfortunately wooden handles are still to be seen. Apparatus for the subcutaneous injection of physiological saline solutions are wanting. The incandescent lamps are most valuable; without them the wounded would have fared badly at the main dressing-station at Loajan.

In conclusion, Wreden ridicules the cant and hypocrisy of people who talk about "modern progress," "the splendid results of civilisation," and the "humanity" of weapons used in war. Japanese bullets kill one man out of three wounded; but this proportion is small as compared with the results of modern, "humane," quick-firing artillery. On August 17th and 18th the Russian guns used about one hundred thousand projectiles, and the Japanese a still higher number. The effects cannot be described without shuddering. The course of the wounds was terrible to witness; all, without exception, were infected, and the rate of mortality was very high. Wreden's account strongly contrasts with the Report of the Omsk Reserve Field Hospitals, a summary of which appeared in the Journal of the Royal Army Medical Corps for March, p. 405.

T. P. Smith.

A Case of Spontaneous Tetanus; Heat and Fatigue as Predisposing Causes.—Surgeon-Major Miramond de Laroquette records a case of tetanus (*Le Caducée*, February 18th), in which no wound or focus of infection could be discovered. The patient was a healthy young soldier, marching with his regiment in Algeria during hot weather and over difficult country. On the evening of the third day he was reported sick, but complained only of general uneasiness. There was no history of injury, he had kept up with his comrades and eaten his food as usual. In the afternoon there was difficulty in swallowing, and opening the mouth, and at 5 o'clock a severe rigor. An hour afterwards the temperature was 40° C. Some kind of throat affection seemed probable, but nothing could be detected, and the case was regarded as one of marked trismus with painful dysphagia. The movements of the head were restricted by stiffness of the neck. No trace of any sort of injury was discoverable, the thoracic and abdominal organs appeared to be quite normal, respiration was free, the mind clear, and questions were distinctly answered. In the evening the man was sent to the nearest hospital, where he died in less than forty-eight hours, during which symptoms of very severe tetanus had become quite characteristic.

The cause of the disease remained altogether obscure, there was no lesion through which Nicolaïer's bacillus could have gained entrance. De Laroquette's hypothesis is as follows: The route taken by the regiment was lined by cactus hedges covered with dust from the road, the men plucked the ripe figs and ate them after more or less careful peeling. The rind of this fruit is often covered with sharp spines, which would easily attach themselves to the lips and to the buccal mucous membrane, or might pass downwards with the pulp. These spines might carry the spores of tetanus, and produce breaches of surface suitable for inoculation, in any part of the alimentary canal, especially in the mouth and upper part of pharynx. This hypothesis would seem to be reasonable, for the idea of viscereal inoculation is supported by the sudden onset of dysphagia and trismus, and the rapid progress of the disease.

If we accept this view of the manner in which the infective material gained admission, there were also the predisposing causes, viz., heat and fatigue. With regard to the former, the connection between tetanus and exposure to severe heat was recognised.

Many years ago, during Napoleon's Egyptian campaigns, Larrey observed many cases, after difficult marches under a burning sun. Lately Vincent has reported a fatal case of very acute tetanus following sunstroke. He has also shown, by experiments on guinea-pigs, that exposure to severe heat causes hypoleucocytosis; the leucocytes were reduced to one-third of their normal number and underwent various alterations. De Laroquette thinks that such changes are due to chemical modifications of the serum. Under the influence of heat and fatigue induced by marching, oxidation processes in the muscles are greatly stimulated, waste products are retained, lactic acid is produced in excess and the toxins of combustion accumulate. These latter destroy the leucocytes, which are also subjected to the negative chemiotaxic action of the lactic acid. Whether this view be correct or not, the white corpuscles, reduced in number, no longer constitute an effective barrier to the germs of tetanus which multiply freely at the infected spot. Vincent believes that the bacillus

may thence be distributed throughout the body. In these acute cases treatment is useless; De Laroquette suggests the free use of the prophylactic method for men exposed to great heat, and during campaigns.

T. P. SMITH.

Preparation of Nutrose Agar. — Since the introduction by von Drigalski and Conradi, in 1902, of their "litmus-lactose-nutrose-agar," and the marked success obtained by Koch and his assistants in the isolation of *Bacillus typhosus* with its aid, this medium has been found to be increasingly useful for the rapid detection of many intestinal organisms, including those of dysentery and (quite recently) of Malta fever. J. W. H. Eyre, having studied the details of its preparation, found that, following closely the directions given, the medium showed a variation in its reaction between + 5 and + 15; that is, various batches of media required the addition of quantities of normal soda solution, varying from about 5 cc. to 15 cc. per litre to render them neutral to phenolphthalein. He then determined what was the best all-round reaction to work with, viz., one close to the optimum for the organism it is desired to isolate, so that its growth may be accelerated; one also that does not markedly affect the litmus solution, either in the acid or alkaline direction; and thirdly, one that is as acid as is compatible with good bacterial growth, in order that the finished medium may be clear and transparent. By actual trial it was found that a medium having the reaction of + 5 fulfilled these conditions; the largest and most vigorous colonies, whether red or blue, of *B. typhosus*, *B. coli*, *B. enteritidis* (Gaertner), *B. dysenteriæ*, being obtained with this preparation, the colour reactions being most clearly contrasted; and motility of bacterial elements being most marked. Eyre describes his method in *Transactions of Pathological Society of London*, 1904, from which the following is condensed. He substitutes ox or sheep serum for watery extract of meat, in order to avoid the occasional presence of inosite or glucose in the latter, which leads to confusing colour reactions with colonies of *typhosus* or *dysenteriæ*; and which cannot be eliminated from meat extract with certainty unless this is inoculated with *B. coli* and incubated for some days.

Preparation of the Medium.—A. Emulsify 20 grammes Witte's peptone in 100 cc. aq. dest. at 60° C.: add 10 g. NaCl. Emulsify 40 g. agar powder in 400 cc. cold aq. dest., and add to the peptone solution in a litre flask. Dissolve by heat, preferably by bubbling live steam through for half an hour.

B. Weigh 500 g. ox or sheep serum into a tared 3-litre flask; add 900 cc. aq. dest., and steam for half an hour.

C. Add *A* to *B*, mix thoroughly, and weigh. Titrate with normal soda solution, adding sufficient to make the reaction 3·5 (that is to say, of such an alkalinity that 3·5 normal HCl. solution are required *per litre*, to bring to dead neutrality with phenolphthalein). Emulsify 20 g. nutrose in 100 cc. aq. dest., add to mixture and steam for half an hour. Weigh, and make up to 2,090 g. with boiling distilled water. Titrate with normal lactic acid solution, making the reaction + 2·5. Cool to below 60° C., add whites of four eggs, heat for thirty to forty-five minutes. Filter through *papier chardin* into tared 2-litre flask, and weigh; about 1,900 cc. or grammes clear "agar" will be obtained. Fill into small

flasks, in quantities of 150 g. in each. This is best done by counterpoising. Sterilise twenty minutes on three successive days.

D. Take as many test tubes as there are 150 cc. flasks, and fill 20 cc. Kahlbaum's litmus solution into each. Steam for twenty minutes. Dissolve 1·5 g. lactose in each tube, and add 1·5 cc. of a 0·01 per cent. solution of crystal violet (B. Höchst). Sterilise twenty minutes on three successive days.

Preparation of the Plates.—Liquefy a flask of nutrose agar, and add a tube of litmus lactose, mixing thoroughly. Pour into Petri dishes (preferably 11 cm. in diameter) to a depth of 3 or 4 mm. Allow steam to escape while the agar sets. Then invert the dishes, and incubate at 60° C. for forty-five minutes, or at 42° C. for two hours, after which the surface will be dry, and ready to inoculate.

To Inoculate the Plates.—Suspend the material to be plated in sterile salt solution or broth, place a few drops on the plate, and smear it over with an L-shaped glass rod. With the same rod, without recharging, smear a second and a third plate, cover, invert, and incubate at 37° C.

A. M. Davies.

JOURNAL

OF THE

ROYAL ARMY MEDICAL CORPS.

Corps News.

May, 1905.

GAZETTE NOTIFICATIONS.—ROYAL ARMY MEDICAL CORPS.

Captain H. W. Vaughan-Williams, M.B., retires on a gratuity, dated April 5, 1905. He entered the Service July 28, 1894, and was promoted Surgeon-Captain July 28, 1897. On August 3, 1900, he was placed on temporary half-pay on account of ill-health, and was restored to full pay March 16, 1901. His war services are as follows: South African War, 1899-1902. Queen's medal with four clasps.

Lieutenant-Colonel P. J. Dempsey, M.D., is placed on retired pay, dated March 28, 1905. He entered the Service August 4, 1878; was promoted Surgeon-Major August 4, 1890, and Lieutenant-Colonel August 4, 1898. His war services are as follows: Afghan War, 1878-80. Medal. Burmese Expedition, 1886-7. Mentioned in Despatches. Medal with clasp.

Captain W. J. P. Adye-Curran, from half-pay, to be Captain, dated March 23, 1905.

Lieutenant J. A. Longley, M.B., resigns his Commission, dated April 8, 1905.

BREVET.

Major William Boog Leishman, M.B., Royal Army Medical Corps, Professor of Pathology, Royal Army Medical College, to be Lieutenant-Colonel, in recognition of his services, and the distinction attained by him in Original Investigation and Research, dated April 15, 1905.

MEMORANDUM.

Surgeon-General Sir J. Hanbury, K.C.B., has been awarded a Good Service Pension.

ROYAL ARMY MEDICAL COLLEGE.—Our readers will be glad to be informed that the contracts for the erection of the new Laboratory and Royal Army Medical College have been signed, and the work of erection has begun. Previous numbers of the Journal detailed information as to the structure of the two buildings. The Laboratory will be completed in eighteen months and the College in two years.

ARRIVALS HOME.—From India: Lieutenant-Colonels A. H. Burlton, W. J. Baker, and T. B. Winter; Majors J. D. Alexander, E. G. Browne, J. H. Curtis, J. C. Connor, and E. M. Morphew; Captains G. J. S. Archer, J. H. R. Bond, H. O. B. Browne-Mason, F. S. Irvine, H. M. Morton, and E. W. Siberry. From Gibraltar: Major T. Birt. From Malta: Captain R. A. Cunningham. From Egypt: Captain A. M. MacLaughlin.

ARRIVALS HOME ON LEAVE.—From India: Lieutenant-Colonel A. W. P. Inman; Captains P. H. Henderson, T. J. Potter, and W. A. Ward. From Egypt: Captain H. Ensor, D.S.O. From Malta: Captain J. H. R. Winder.

EMBARKATIONS.—For Malta: Major C. E. Pollock and Captain P. Evans.

POSTINGS.—Majors J. D. Alexander, J. H. Curtis; Captains W. J. P. Adye-Curran, G. J. S. Archer, A. M. MacLaughlin, and E. W. Siberry, to Irish Command. Lieutenant-Colonels W. J. Baker, A. T. I. Lilly; Majors T. Birt and E. M. Morphew, to Eastern Command. Lieutenant-Colonel T. B. Winter; Major A. B. Hinde, and

Captains J. H. R. Bond and E. E. Ellery, to Southern Command. Captain H. O. B. Browne-Mason to London District. Captain R. A. Cunningham to Scottish Command.

LIST OF CASUALTIES &c.:—

Discharges.—5849 Quartermaster-Sergeant W. Lawrence, termination second period, March 27; 7481 Quartermaster-Sergeant E. Morton, after eighteen years' service, March 22; 6818 Quartermaster-Sergeant F. J. McHugo, after eighteen years' service, March 18; 15621 Staff-Sergeant A. J. Callinge, termination of engagement, April 5; 15701 Staff-Sergeant J. Withers, termination of engagement, March 24; 15561 Sergeant R. Wilkinson, termination of engagement, March 12; 9856 Sergeant A. Butler, medically unfit, March 28; 12191 Corporal W. A. Sweetman, medically unfit, March 14; 15173 Corporal T. Honess, termination of engagement, March 15; 15171 Corporal A. J. Simmons, termination of engagement, March 14; 15473 Corporal G. H. Raling, termination of engagement, March 18; 15175 Lance-Corporal F. Quiller, termination of engagement, March 15; 15429 Lance-Corporal C. Gardiner, termination of engagement, March 20; 15172 Private F. Betts, termination of engagement, March 15; 15564 Private R. Kendall, termination of engagement, March 13; 15567 Private M. Shea, medically unfit, March 14; 15568 Private W. J. T. Healy, termination of engagement, March 17; 15536 Private R. Messenger, termination of engagement, March 21; 15294 Private E. Dunlan, termination of engagement, March 25; 15295 Private F. W. Ristow, termination of engagement, March 25; 13345 Private T. R. Johnston, medically unfit, March 30; 15535 Private T. Beaufoy, termination of engagement, March 23; 14759 Private H. Redgate, free after twelve years, March 31; 15531 Private J. Parker, termination of engagement, April 1.

Transfers to Reserve.—17365 Private F. McDonald, March 4; 17392 Private A. Ashden, March 10; 17422 Private H. Winwood, March 16; 17429 Private J. Whittaker, March 18; 17446 Private J. Ritchie, March 19; 17449 Private F. W. Smith, March 20; 17445 Private J. McCondochie, March 19; 17467 Private J. Wilson, March 24; 17488 Private A. Smith, March 31; 15717 Private J. Green, February 16; 17504 Private E. Wilkinson, April 2; 15939 Private J. Holden, April 1; 15940 Private E. O'Driscoll, April 1; 17503 Private J. Lynch, April 2; 17505 Private F. E. Holden, April 3; 17516 Private A. E. Pitcher, April 6; 17515 Private R. W. Robertson, April 6; 17532 Private D. Brown, April 8; 17507 Private D. T. Davis, April 4; 17540 Private W. Shergolt, April 4; 17536 Private W. Bunkell, April 9.

Transfers to other Corps.—19490 Private H. Pridgeon to Royal Field Artillery, April 1.

Death.—18140 Private A. N. Roberts, tubercle of lung, March 19.

Embarkations.—To Bermuda, per s.s. "Port Maria," February 18; 6882 Sergeant-Major H. Barrett, 17706 Private D. Phillips.

To Malta, per H.T. "Dilwara," March 24: 7746 Sergeant G. Cowthard, 9941 Corporal W. Allen, 18803 Private R. Bignall, 18984 Private B. Breeze, 11864 Private S. W. Brooke, 18015 Private W. H. Didon, 18551 Private W. T. Foster, 17541 Private P. McCoan, 17726 Private C. P. Murphy, 19123 Private A. G. Smith, 17879 Private J. Stewart, 18089 Private J. W. Thatcher, 18693 Private R. Williams, 17840 Private H. Walker.

To Gibraltar per H.T. "Dilwara," March 24: 10336 Corporal F. J. Howell.

Disembarkations. — From Egypt, per H.T. "Dilwara," March 15: 16315 Private J. Boylan, for discharge; 11195 Private J. Harris, invalided.

From Malta, per H.T. "Dilwara," March 15: 16396 Private J. F. Beckwith, 17727 Private A. Wrigley, invalids.

From Jamaica, per s.s. "Atrato," March 24: 18853 Private S. Wilcock, for discharge.

From Ceylon, per s.s. "Oroya," March 12: 10224 Staff-Sergeant A. P. Barnard, tour expired.

From Egypt, per s.s. "Soudan," March 24, on reduction of establishment: 10709 Corporal T. Fitzgerald, 17547 Private G. E. Burton, 17910 Private W. Green, 14782 Private G. S. Oakes, 14684 Private W. Porter, 12346 Private D. McReavie, 12093 Private J. A. Bushaway, 17549 Private J. H. Pepper, 14750 Private J. McFarlane, 14786 Private A. Peavoy, 17801 Private A. Crighton, 17799 Private C. S. Brown, 12515 Private J. Shepherd.

From Barbadoes, per R.M.S. "Trent," April 6, tour expired: 6260 Sergeant-Major G. Grieve, 8682 Sergeant G. Read, 11338 Sergeant W. Grove, 12743 Corporal T. R. Wilson, 12172 Private J. Doolan.

From Egypt, per s.s. "Plassy," March 25: 8876 Corporal J. W. Legge, tour expired.

From Canada, per s.s. "Ionian," April 1: 17505 Private F. E. Holden, for Reserve.

From South Africa, per s.s. "Galeka," March 30: 9651 Staff-Sergeant E. Birch, tour expired; 15939 Private J. Holden, 15940 Private E. O'Driscoll, for Reserve.

From Bermuda, per s.s. "Port Maria," March 28: 6358 Sergeant-Major H. A. Davidson, tour expired.

From Mauritius, per s.s. "Newark Castle," tour expired: 5973 Quartermaster-Sergeant P. T. D. Scammell, 19200 Staff-Sergeant J. H. Thomas, 14810 Corporal W. H. Colville, 8240 Corporal J. P. Jones, 15743 Private T. E. Palmer, 12474 Private W. Sater, 9227 Private E. York.

NOTES FROM THE CURRAGH.—Captain F. G. FitzGerald, R.A.M.C., writes: "Lieutenants R. C. Hallowes, J. H. Campbell, G. D. A. Harvey, W. H. Russell, A. N. Fraser, H. O. M. Beadnell, R.A.M.C., arrived from Aldershot on February 2 for duty. Captain F. G. FitzGerald, R.A.M.C., arrived for duty on February 17, and took over the duties of Company Officer from Captain E. W. W. Cochrane, R.A.M.C., who proceeded on leave prior to embarking for the West Coast of Africa. Lieutenant-Colonel J. Battersby, R.A.M.C., left the station on February 7, having been appointed Medical Officer in charge Recruiting at Chester. Lieutenant-Colonel H. J. Wyatt arrived from Dublin for duty on March 7. Lieutenant M. D. Ahern embarked for India on February 10 last.

"The Football team of the 17th Company, R.A.M.C., are still fighting in the Curragh District Football League, and their position, taking everything into consideration, is fairly satisfactory, heading the various Corps, although being by far the smallest unit. Owing to some of the best players having been on furlough since Christmas, the teams that have been put into the field have not been as strong as they might have been. Corporal Connor, Privates Mayo and Curry, have done yeoman service for the team."

Curragh District Military Football League Table.—March 4, inclusive.

Teams	Played	Won	Lost	Drawn	Goals		Points
					For	Against	
1st Battalion S. Staffordshire Regt...	13	12	1	—	52	12	24
19th Hussars	13	11	2	—	53	10	22
11th ,, ...	14	9	3	2	33	24	20
Royal Field Artillery (Newbridge) ..	15	9	6	—	65	43	18
,, ,, ,, (Kildare) ..	13	7	6	—	32	17	14
Royal Horse Artillery	13	6	6	1	33	35	13
4th Battalion Rl. Warwickshire Regt.	12	6	6	—	28	31	12
Royal Army Medical Corps	14	4	8	2	12	43	10
Royal Engineers	13	3	10	—	14	34	6
Army Ordinance Corps	10	2	8	—	12	30	4
Army Service Corps	13	—	12	1	5	57	1

NOTES FROM NETLEY.—Lieutenant Colonel G. Twiss, R.A.M.C., writes: "Fourteen Lieutenants on probation, Indian Medical Service, arrived for a course on April 1.

"*Farewell Dinner to Surgeon-General Sir E. Townsend, M.D., K.C.B., C.M.G.*

"The officers entertained the Surgeon-General at Mess on April 3. The health of the guest of the evening was proposed by Lieutenant-Colonel Sylvester, in suitable terms, to which Sir Edmund replied that 'From the day he first put this uniform on in the Netley mess until the present occasion, when he now wore it there for the last time, he had never regretted the career on which he had entered. Many said they were glad to leave the Service, but as for himself, his feelings were those of profound sorrow that age compelled him unwillingly to relinquish it.'"

NOTES FROM PORTSMOUTH.—Captain J. D. S. Macpherson, R.A.M.C., writes: "Lieutenant-Colonel J. G. Harwood has taken over charge of the Military Hospital here, vice Lieutenant-Colonel P. J. Dempsey, who has retired. On March 22 a farewell dinner was given to Lieutenant-Colonel Dempsey, and proved a great success, being largely attended.

"On March 23 a meeting was held by all those interested in cricket to elect a Captain and arrange generally for the coming cricket season. At the meeting Lieu-

tenant and Quartermaster A. Lunney was elected Captain. A good list of fixtures has been arranged by Lieutenant-Colonel J. G. Harwood and Major G. T. Rawnsley.

"We are giving a dance on May 5 at the Esplanade Assembly Rooms, and it is hoped that it will prove a great success. Three hundred invitations have been issued.

"The following officers have reported their arrival for duty in the Portsmouth District: Major R. H. Penton, D.S.O., and Major A. B. Hinde.

"The Commanding Officer hopes to arrange an Athletic Meeting for No. 6 Company, R.A.M.C., stationed here, an event which should prove very popular with the men."

NOTES FROM THE BARBADOS COMMAND.—Lieutenant-Colonel F. P. Nichols, R.A.M.C., Officer Commanding Station Hospital, Barbados, writes: "Lieutenant-Colonel F. P. Nichols has been granted leave of absence from April 15 to August 15, 1905, for the purpose of proceeding to the United Kingdom on private affairs.

"Lieutenant-Colonel H. C. Kirkpatrick, Senior Medical Officer, Barbados Command, will take over the duties of Officer Commanding Military Hospital, Barbados, and Detachment R.A.M.C., from April 1, in addition to his own administrative duty as Senior Medical Officer of the Command.

"The following Warrant Officer, Non-Commissioned Officers and men arrived at Barbados on March 13, for a tour of duty in the Command: 7385 Sergeant-Major W. E. Hill; 8540 Sergeant F. C. E. Godbolt; 17454 Corporal E. C. Allport; 18005 Private F. K. Churchill; 17514 Private R. Laverty.

"The undermentioned Warrant Officer, Non-Commissioned Officers and men having completed a tour of service in the Barbados Command, embarked for the United Kingdom on March 25, 1905: 6260 Sergeant-Major G. Grieve; 8682 Sergeant G. Read; 11338 Corporal T. R. Wilson; 12172 Private J. Doolan."

NOTES FROM GIBRALTAR.—The German Emperor landed on Saturday, the 1st inst., and drove with His Excellency the Governor, General von Plessen, and Major Agnew, A.M.S., to the Military Hospital, where he made a minute inspection. His Majesty was much struck with the admirable arrangements in the new building, and before leaving presented two paintings for the hospital and a signed photograph to Lieutenant-Colonel Bedford, C.M.G., R.A.M.C., the Officer-in-charge of the Station Hospital. His Majesty afterwards drove to Europa before returning to the Governor's landing stage.

NOTES FROM JAMAICA.—Major Hodgens, R.A.M.C., writes: "Major Mangin, R.A.M.C., arrived from England on March 17, for duty, and has been posted to the Station Hospital, Up-Park-Camp. Captain Archer, R.A.M.C., left on March 20 for England, tour expired.

"On March 19 a Gymkhana was held at Up-Park-Camp. The Lloyd-Lindsay Event was carried off by the Royal Army Medical Corps Team, consisting of Majors Hassard and Samman, Captains Archer and French."

NOTES FROM MHOW, INDIA.—Lieutenant-Colonel J. R. Dodd, R.A.M.C., writes: "That Mhow, under Lord Kitchener's reorganisation, is becoming a much more important Station, being the headquarters of the 5th Division of the Indian Army. There are about 1,700 British and 2,000 Native troops. The Station and Section Hospitals are among the best in India. The following Royal Army Medical Corps officers are here at present: Colonel Pratt, Lieutenant-Colonel J. R. Dodd, Major Symons, Captains O'Flaherty, Tobin, Douglass and Beatty, and Lieutenants MacDowall, Hole and Meaden. The last named is, unfortunately, on the sick list with enteric fever, but is doing well. There is a good residential club where unmarried medical officers live, and sport of all kinds—shooting, fishing, pig-sticking and hunting—are obtainable in the neighbourhood, besides polo, golf, tennis, &c. The climate is one of the best all round in India, never too hot or too cold; hot weather short and quite bearable for ladies and children. Rains not excessive (20 to 30 inches), with cool weather and delightful cold weather for four months. This year it has been unusually cold, with many frosty nights, and those of us who were out on divisional manœuvres for three weeks needed all the clothing we could get to keep warm under canvas. All returned as fit as if we had been home and much browner. From all this, medical officers will gather that Mhow is a Station to go for."

NOTES FROM PRETORIA.—Major H. J. M. Buist, R.A.M.C., writes: "The following change of Station has taken place during the month of February: Lieutenant H. H. J. Fawcett from Mooi River, Natal (on closing of hospital), to Bloemfontein."

NOTES FROM QUETTA, BALOOCHISTAN.—Lieutenant N. Dunbar Walker, R.A.M.C., writes: "We have had a very severe winter, one fall of snow measuring 2 feet and the thermometer registering 41° of frost one night in January; in consequence it has been difficult to get out shooting, and also hunting has been stopped for nearly two and a half months, these being our winter amusements. We have had several changes lately. Major H. W. Austin, Captain J. Baillie and Lieutenant J. D. Richmond have joined us from home. Captain Furnivall sails for Aden next week, and Captain A. J. Williamson goes to Hyderabad (Sind), exchanging with Captain C. H. Carr."

QUEEN ALEXANDRA'S IMPERIAL MILITARY NURSING SERVICE:—

The following ladies have received appointments as Staff Nurses: Miss M. Brown, Miss E. C. Ellis.

Postings.—As Staff Nurses: Miss S. O. Beamish, to Station Hospital, Shorncliffe, for temporary duty; Miss E. M. Goard and Miss E. J. Minns, to Connaught Hospital, Aldershot.

Changes of Station.—Matron: Miss A. Garriock, R.R.C., is appointed Matron at the Royal Herbert Hospital, Woolwich, on return from Indian Troopship Duty.

Sisters: Miss E. C. Humphreys, to Royal Herbert Hospital, Woolwich, on return from Indian Troopship Duty; Miss M. R. Makepeace, to Royal Victoria Hospital, Netley, on return from South Africa.

Staff Nurses: Miss E. Barber and Miss B. F. Perkins, to Malta, from Connaught Hospital, Aldershot; Miss E. M. Lang, to Royal Victoria Hospital, Netley, from Lincoln.

Appointments Confirmed.—Staff Nurses: Miss G. M. Allen, Miss K. M. Bulman, Miss L. M. Dann, Miss F. A. Dawson, Miss A. M. M. Denny, Miss E. M. Fairchild, Miss E. Foster, Miss M. E. M. Grierson, Miss O. M. Griffin, Miss E. M. Lyde, Miss A. M. Orchard.

Promotions.—The undermentioned Staff Nurses to be Sisters: Miss A. R. F. Auchmuty, Miss S. K. Bills, Miss B. N. Daker, Miss G. Knowles, Miss C. Mackay, Miss W. G. Massey, Miss B. Rennie, Miss M. Worthington.

ARMY MEDICAL RESERVE OF OFFICERS.

Lieutenant M. S. W. Gunning, Leicester and Lincoln Brigade Bearer Company, Royal Army Medical Corps (Volunteers), to be Surgeon-Lieutenant, dated March 29, 1905.

Surgeon-Captain C. R. Lawrie, to be Surgeon-Major, dated March 25, 1905.

ROYAL ARMY MEDICAL CORPS (MILITIA).

Daniel Vere Maxwell Adams, M.B., to be Lieutenant, dated March 25, 1905.

IMPERIAL YEOMANRY.

Montgomeryshire.—Surgeon-Captain F. E. Marston, resigns his Commission, dated March 18, 1905.

ROYAL ARMY MEDICAL CORPS (VOLUNTEERS).

Sherwood Foresters, Bearer Company.—Captain R. H. Luce, M.B., is granted the honorary rank of Major, dated April 5, 1905.

OTHER VOLUNTEER CORPS.

The Electrical Engineers (Volunteers).—Surgeon-Lieutenant C. H. Leaf, M.B., to be Surgeon-Captain, dated February 28, 1905.

1st Volunteer Battalion the Queen's (Royal West Surrey Regiment).—Surgeon-Captain R. J. Swan, from the 1st Surrey (South London) Volunteer Rifle Corps, to be Surgeon-Captain, dated March 18, 1905.

1st Volunteer Battalion the Suffolk Regiment.—Supernumerary Surgeon-Major G. S. Elliston (Brigade-Surgeon-Lieutenant-Colonel, Senior Medical Officer, Harwich Volunteer Infantry Brigade) to be Surgeon-Lieutenant-Colonel, and to remain seconded, dated March 18, 1905.

4th (Nottinghamshire) Volunteer Battalion the Sherwood Foresters (Nottinghamshire and Derbyshire Regiment).—Supernumerary Surgeon-Major F. H. Appleby (Brigade-Surgeon-Lieutenant-Colonel, Senior Medical Officer, Sherwood Foresters Volunteer Infantry Brigade) to be Surgeon-Lieutenant-Colonel, and to remain supernumerary, dated March 18, 1905.

1st Volunteer Battalion the Manchester Regiment.—Surgeon-Lieutentant-Colonel

W. M. Roocroft is granted the honorary rank of Surgeon-Colonel, dated March 18, 1905.

2nd (Hertfordshire) Volunteer Battalion the Bedfordshire Regiment.—Surgeon-Lieutenant J. B. McBride to be Surgeon-Captain, dated March 25, 1905.

2nd (Westmorland) Volunteer Battalion the Border Regiment.—Surgeon-Major G. W. Brumwell (Brigade-Surgeon-Lieutenant-Colonel, Senior Medical Officer, Lancaster and Border Volunteer Infantry Brigade) to be Surgeon-Lieutenant-Colonel, dated March 25, 1905.

Surgeon-Lieutenant-Colonel G. W. Brumwell (Brigade-Surgeon-Lieutenant-Colonel, Senior Medical Officer, Lancaster and Border Volunteer Infantry Brigade) is granted the honorary rank of Surgeon-Colonel, dated March 25, 1905.

1st Volunteer Battalion the Northamptonshire Regiment.—Charles Humphrey Sedgwick, Gent., to be Surgeon-Lieutenant, dated March 25, 1905.

2nd Volunteer Battalion the Queen's Own (Royal West Kent Regiment).—Surgeon-Major H. W. Roberts to be Surgeon-Lieutenant-Colonel, dated March 25, 1905.

1st Sutherland (the Sutherland Highland).—John MacLennan, late Surgeon-Lieutenant, to be Second Lieutenant, dated March 25, 1905.

8th Lancashire.—Surgeon-Lieutenant-Colonel A. R. Hopper, resigns his Commission, and is granted the honorary rank of Surgeon-Colonel, with permission to wear the prescribed uniform, dated March 29, 1905.

1st Volunteer Battalion the Royal Welsh Fusiliers.—Surgeon Lieutenant W. F. Byford resigns his Commission, dated March 29, 1905.

2nd Volunteer Battalion the Sherwood Foresters (Nottinghamshire and Derbyshire Regiment).—Surgeon-Captain W. Moxon, resigns his Commission, and is granted the honorary rank of Surgeon-Major, with permission to wear the prescribed uniform, dated March 29, 1905.

Surgeon-Lieutenant V. J. Greenhough, M.B., to be Surgeon-Captain, dated March 29, 1905.

4th Middlesex (West London).—Surgeon-Lieutenant-Colonel A. Clark (Brigade-Surgeon-Lieutenant-Colonel, Senior Medical Officer, 3rd London Volunteer Infantry Brigade) is granted the honorary rank of Surgeon-Colonel, dated March 14, 1905.

The Mersey Division Submarine Miners, Royal Engineers (Volunteers).—John Owen, Gent., to be Surgeon-Lieutenant, dated April 5, 1905.

7th Volunteer Battalion the Royal Scots (Lothian Regiment).—Surgeon-Lieutenant-Colonel J. L. Crombie, M.D., resigns his Commission, and is granted the honorary rank of Surgeon-Colonel, with permission to wear the prescribed uniform, dated April 5, 1905.

PRESENTATION TO THE ROYAL ARMY MEDICAL CORPS MESS, ALDERSHOT.

A HANDSOME tea-kettle has been presented to the Aldershot Mess, through Major Faichnie, by the Officers of No. 10 General Hospital, South Africa.

ROYAL ARMY MEDICAL CORPS ANNUAL DINNER.

THE Annual Dinner of the Corps will take place on Monday, June 19, at the "Whitehall Rooms," Hôtel Métropole, at 8 o'clock, precisely; the Director-General in the chair. Members intending to dine are requested to inform the Hon. Secretary as soon as possible, in order that the probable number attending may be known and that tickets may be sent.

All subscribers to the R.A.M.C. Fund, except any who may have expressly excluded the Annual Dinner in the allocation of their subscriptions, will be entitled to dine at subscribers' rates, provided that their subscriptions are credited to the R.A.M.C. Fund before the date of the dinner; also all Officers who do not subscribe to the R.A.M.C. Fund, but who still subscribe to the former R.A.M.C. Dinner Fund.

The price of the Dinner to subscribers will be 12s. 6d. The amount should be paid personally at the Hotel on the evening of the dinner.

The price to non-subscribers will be £1 15s., which must be sent by cheque or Post

Office Order to the Hon. Secretary when applying for tickets. If the Officer is unable to dine the money will be returned.

H. C. Thurston, *Major, R.A.M.C.,*
Hon. Sec., Sub-Committee, R.A.M.C. Dinner Fund.
66, *Scarsdale Villas, Kensington, W.*

THE ROYAL ARMY MEDICAL CORPS FUND.

Notice of Third General Meeting.

The Third General Meeting of subscribers to this Fund will be held in the Theatre of the Royal United Service Institution, on Monday, June 19, 1905, at 3 p.m. The Director-General will preside.

It is hoped that officers will freely express their views on any points connected with the Fund which they may wish discussed. Those officers who wish for information at the meeting on any special point are asked to communicate with the Hon. Secretary at 68, Victoria Street, S.W., in order that facts and figures may be prepared in response to any question asked.

The Director-General wishes to remind subscribers that the question of the Benevolent Fund being administered by the Royal Army Medical Corps Fund will be before the meeting. It is hoped that the subscribers to the Benevolent Fund will lay their views before this General Meeting of the Royal Army Medical Corps Fund subscribers.

The question of the "Colours" will also be up for final decision.

ROYAL SCHOOL FOR THE DAUGHTERS OF OFFICERS OF THE ARMY.

Election, June, 1905.

The Director-General would be glad if Officers, who may have a vote or votes at their disposal in connection with the Royal School for the Daughters of Officers of the Army, would support the claims of Geraldine Eva Peard (9 years of age), daughter of the late Lieutenant-Colonel H. J. Peard, C.M.G., R.A.M.C.

Lieutenant-Colonel Peard was a distinguished officer of our Corps, and after serving throughout the South African War he died at Middelburg, Cape Colony (after only three days' illness), from malignant scarlet fever, contracted in his attendance on cases of the disease.

Officers may perhaps be able to render assistance in this case by securing the support of any friends they may have among subscribers.

Communications in this matter should be addressed to Major T. McCulloch, R.A.M.C., 68, Victoria Street, London, S.W.

ANNUAL REPORT OF THE CHATHAM GARRISON HOSPITAL (MILITARY FAMILIES' HOSPITAL) FOR THE YEAR ENDING DECEMBER 31, 1904.

In Charge—Major E. Keble, R.A.M.C.
Head Nurse—Miss B. M. E. Bygott, L.O.S., Army Nursing Service (Reserve).
Nurses—Miss Cairney, L.O.S. ; Miss Bayliss, L.O.S.

A Committee of Officers appointed by the General Officer Commanding has charge of a Charitable Fund connected with the Institution, and all unofficial financial matters are to be referred to them. *President* and *Hon. Treasurer*, Major A. E. C. Keble, R.A.M.C.

All Women and Children on the strength of their Corps, including Royal Marines, are treated free of expense. Copies of the Rules can be obtained on application to the Officer in charge.

NOTICE TO SUBSCRIBERS.

OFFICERS are particularly requested to give timely notice of changes of station or changes of address, in order to ensure the posting of the Journal to its correct destination.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, &c. He will also be glad to receive items of news and information regarding matters of interest to the Corps from the various garrisons, districts and commands at home and abroad. All these communications should be written upon one side of the paper only, they should by preference be type-written, but, if not, all proper names should be written in capital letters (or printed) to avoid mistakes, and be addressed to the Editor, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, 68, Victoria Street, London, S.W.

Letters regarding subscriptions, non-delivery of the JOURNAL, or change of address, should be sent to Major T. McCulloch, R.A.M.C., 68, Victoria Street, London, S.W.

Communications have been received from Lieutenant-Colonels A. M. Davies, G. T. Goggin, B. Skinner, H. Hathaway, J. R. Dodd; Majors J. C. Weir, F. J. W. Porter, W. Mould, R. H. Penton, J. G. McNaught; Captains H. V. Prynne, D. Harvey, F. J. W. Porter, D.S.O.; Lieutenant C. R. Bradley; G. H. Makins, Esq., C.B., Dr. T. P. Smith.

In the event of reprints of articles being required by the authors, notification of such must be sent when submitting the papers. Reprints may be obtained at the following rates, and other reprints at proportionate rates:—

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In forwarding parts for binding the name and address of sender should be enclosed in parcel.

The following periodicals have been received: *The Medical Record, The Medical News, New York Medical Journal, American Medicine, Gazette Med. de Paris, Archives de Medicine et de Pharmacie Militaires, Il Morgagni, Gazetta Medico-Italiana, The Medical Review, El Siglo Medico, Der Militärärzt, Deutsche Militärärztliche Zeitschrift, Anales de Sanidad Militar, Revue Med. de la Suisse Romande, La Medicina Militar Espanola, The Boston Medical and Surgical Journal, Annali di Med. Navale, Giornale del Regio Esercito, Le Caducée, The Hospital, The Ophthalmoscope, St. Thomas's Hospital Gazette, Bulletin de l'Acad. de Med. de Paris, Arch. Med. Belges, Voyenno Medisinskii, The Indian Medical Gazette, The Australasian Medical Gazette, Journal of the Association of Military Surgeons, U.S., Militärlagen ungwet af Militärlaegeforeningen, i Kjobenharn, The Veterinary Journal, The Practitioner, Public Health, Medical Review, The Army and Navy Gazette, The United Service Gazette, Journal of the Royal United Service Institution, The Johns Hopkins Press, The Health Resort and Journal of Spas and Sanatoria, Journal of the Royal Sanitary Institute, Journal of the U.S. Institution of India.*

We desire to remind members who have not paid their second year's subscription, which was due on July 1, 1904, that it is very important that such should be promptly paid.

NOTICE.

The Corps News is now printed as an inset to the Journal and separate copies may be subscribed for, price 2d. monthly.

Volume IV. JUNE, 1905. No. 6.

Journal

of the

Royal Army Medical Corps.

Original Communications.

THE DIRECT TRANSMISSION OF ENTERIC FEVER.

By Lieutenant-Colonel A. M. DAVIES.
Royal Army Medical Corps.

III.—Further Evidence as to Direct Contagion.

In India, the localisation of incidence in company, or barrack, outbreaks has been frequently noticed. Three instances that have come under the writer's personal observation may be mentioned.

At Dagshai, in 1897, there were admitted sixty-six cases in the space of three months; of these twenty-five were derived from D and F companies, the Queen's regiment; the first case in D company was admitted on March 24th, the subsequent admissions were on March 29th, April 4th, 10th, 12th (2), 13th, 15th, May 7th, 23rd, June 14th, July 3rd; the first case in F company was admitted on May 6th, the subsequent admissions were on May 10th, 18th, 30th, June 24th, 26th, 27th, 28th (2), 30th (2), July 1st, 4th, 6th. There must have been some local condition causing this excessive incidence on these two bodies of men.

At Cherat, in 1898, eighty-one cases occurred between May and October, sixty-eight being admitted during June and July. D company contributed eleven cases, the first on May 27th, the second on June 10th, the third on the 25th, the fourth on the 28th; then seven cases between July 5th and 20th.

At Quetta, in 1898, an extensive epidemic prevailed, amounting

to 216 cases; the incidence was very unequal in different parts of the lines, the salient fact being that some bungalows suffered severely and others escaped altogether. From one bungalow (No. 9) accommodating 128 men, cases were admitted as follows: July 6th, 17th, 26th, 29th, 30th; August 3rd, 6th, 25th, 28th; September 20th, 24th; October 11th, 13th, 20th, 26th, 30th; total sixteen cases. From No. 11 bungalow also sixteen cases were admitted: July 8th, 17th, 29th; August 1st, 7th, 23rd, 25th; September 5th, 7th, 17th, 27th, 29th; October 1st, 4th, 11th, 12th.

Other examples might be quoted if necessary: the actual causation of these outbreaks is not just now in question, but it is evident that the continuance of the prevalence was due to some *localised* condition. (It is to be understood that any *general* cause, such as water, &c., could be excluded.) These indeed are similar, on a small scale, to the German outbreaks mentioned in the first part of this paper (pp. 588-9), which Koch and his fellow-workers ascribed to contact infection. It will be noticed how often small groups of cases occur, then an interval of a week or ten to fourteen days, then another group of cases. But although these cases were due to some localised condition, it does not follow that they were due to direct contagion, in the strict sense, and the use of the expression "contact epidemic" by the German observers is in some instances open to criticism. Thus at Sarrebrück, 1898, they state that "it is evident that one must refer to contact infection all the admissions after the first three weeks" (the original infection having been introduced in a potato salad); and again, at Strasbourg, 1900, the "filiation" of all the cases could be demonstrated, "their origin was either the use of a latrine in common, or a common barrack room" (p. 589). Infection due to a latrine cannot be accurately called "direct contact," or "immediate," the latrine being obviously an intervening "medium." It may be impossible to discriminate between latrine infection and direct contagion through living in the same room with infected persons, but in some instances there may be a strong probability one way or the other. Now, in these Indian cases there is a very strong probability that the infection did spread by means of the latrines[1] (on account of the known defects of the dry earth system), and not by direct contact (the bungalows being large and well-ventilated, and there being no overcrowding). At Dagshai there were two special reasons in favour of this suppo-

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[1] A good account of a latrine outbreak has been recorded by Captain B. B. Burke, Journal of the Royal Army Medical Corps, January, 1905.

sition : (1) The latrines and cookhouses were within a few feet of each other, and flies were abundant, no doubt conveying infection from the one building to the other ; (2) dry earth was not used to cover the excreta, the specific stools were therefore freely exposed. At Quetta, also, the latrines were probably responsible for a large amount of the prevalence, at any rate in the later part of the epidemic. It does not appear to be accurate to style these "contact epidemics," without some qualification, though they were, in great part, strictly "localised outbreaks."

At Dagshai, 1897, seven cases originated in the hospital, which was overcrowded and of defective construction ; three of these cases were special orderlies over enteric patients ; at Quetta, 1898, seven cases also originated in hospital, one being a special orderly. These fourteen cases were due to direct contagion.

During the years 1897-1900 the present writer made enquiries into the causation of twelve outbreaks of enteric fever in different parts of India. The total aggregate of cases amounted to 898 ; of these, nineteen could be affirmed with tolerable certainty to have contracted the infection while patients in hospital, *i.e.*, 2·1 per cent. Six other cases contracted infection whilst employed as nursing orderlies over enteric patients, *i.e.*, 0·67 per cent. ; making a total of 2·8 per cent. due to direct infection. These figures are, however, too small to allow of any conclusion being drawn from them as to the real amount of prevalence of hospital infection in that country.

During the eleven years, 1893 to 1903 inclusive, there have been 1,410 admissions for enteric fever in military hospitals at home. Out of this number 19 cases are recorded as having been probably contracted from another patient in hospital ; whilst 37 cases have occurred amongst nursing attendants, either men of the Royal Army Medical Corps, or special regimental orderlies. In addition to these, an uncertain number of cases (about 16) appear to have been due to infection contracted on board ship ; and a small number of cases have been admitted, having apparently become infected from convalescent enteric patients occupying the same barrack room. At Portland, in 1901, twelve or thirteen cases appeared to be due to direct infection in this manner. One case at the Curragh in 1900, and three at Dover in 1902, seem to have originated in the same way ; but exact details are not forthcoming.

With regard to the Portland outbreak, the writer investigated the circumstances and submitted a report, from which the following particulars are extracted. Between December 20th, 1900, and

September 17th, 1901, there were 18 admissions for enteric fever, the first 10 of which occurred between December 20th and March 10th; the last 8 between July 20th and September 17th. Between March 10th and July 20th there were no cases; neither had there been any at this station for five years before. In the first group of 10 cases, all except one were admitted from one range of casemates (south-east range), although the occupants of this range numbered only about half those in the south-west range (250 as compared with 480); the exceptional case was a hospital orderly who had been in attendance on enteric fever patients. The range of casemates was evacuated, and no more cases occurred until the disease was imported again in the following July. As to the origin of the first outbreak in December, 1900, enquiry failed to discover any probable source of infection in the water or food supplies, or from any local insanitary condition in the barracks or surrounding neighbourhood. The man first attacked, Private Puryer, had been twenty-seven days in the station before being taken ill, and had hardly been outside the citadel during the whole of that time. The only possible, or at least probable, origin seemed to be importation by convalescents returned from South Africa.

"It appears that the barracks were first occupied by invalids returned from South Africa on December 4th, 1900, when the Details, 2nd Northampton Regiment took over the south-east casemates from the 3rd Northampton (Militia). In No. 13 room (where Private Puryer stayed) there was Corporal Goss, an enteric convalescent, who arrived from South Africa in s.s. *Dilwara*, and is said to have joined at Portland on October 10th, 1900. In the adjoining room, No 12, there were 9 returned enteric convalescents previous to the occurrence of the four cases that were admitted from this room. The men of Nos. 12 and 13 rooms messed together in No. 12 room.

"It appears therefore that in these two barrack rooms, accommodating 20 men in each, there were 10 enteric convalescents, brought into most intimate association with the remaining 30 inhabitants as regards their living, sleeping, and eating, and as regards using the same latrines and urinals. Five cases of enteric fever occurred among these men (one of them in the person of a returned convalescent). As to the first case (Private Puryer) it has already been stated that neither infection at Newport Pagnell (where he had been on furlough) nor in Portland, nor by milk, was a likely explanation for the occurrence of the illness. The only remaining source of infection, viz., from association with enteric convalescents,

must, in my opinion, be considered a highly probable explanation. As to the exact mode of conveyance of the poison, it is impossible to prove anything; but there were certain conditions which would aid in the propagation of the poison, supposing it were present in the person of any of these convalescents.

"I do not think there would be much danger in messing in the same room, that is, in the actual eating at the same table, supposing the men were ordinarily clean in their habits; and the whole 40 men could hardly have had their dinners all together. But as regards sleeping in the same room and habitually breathing the same air, the risk of infection (supposing the convalescents to have been infective) would be considerable. All the rooms are casemates, and consequently very badly ventilated at the best. They were not, according to regulation, over-crowded, and the air space and floor space were up to the allowance; but the space between beds was little more (sometimes less) than two feet, and in the absence of any means for rapidly changing the air, there is no doubt that any infective exhalations or emanations from one occupant might easily be breathed or swallowed by another on either side. Moreover, I was informed by Dr. Henley that it was the fact that occasionally men would commit a nuisance in the back corridor into which the barrack rooms open, either from inability, or more likely from not taking the trouble, to get so far as the latrine and urinal outside. Urine tubs are provided, placed in the front porches, but I was informed that the men would occasionally urinate in the back corridor (perhaps being more accessible and less cold). Therefore, if any of these returned convalescents had any infective property in their bodies or excretions, it is not at all unlikely that the infection might have been spread, on account of the air of the rooms, or of the corridor, becoming charged with the infective matter, which might then be breathed or swallowed by the occupant of a neighbouring bed.

"As to propagation through using the same latrines, this is not impossible, though I think less likely. These latrines are certainly not of a pattern to rapidly and completely carry away the excreta, which, on the contrary, might remain in the latrine for half a day or more, and get splashed about, dried, and turned into dust. As to urinals, on account of the very defective flushing, these were very often dry; therefore urine or urinary dust might be easily disseminated through the air. But it is the intimate association in an ill-ventilated space that I consider to have been, on the whole, the most likely condition in spreading infection."

Dr. Caiger, at the meeting of the Epidemiological Society already mentioned (p. 600), had observed "that there was not sufficient appreciation of the fact that infection may be derived from a patient by means of some dry discharge which, owing to the movement or the manipulation of the patient or the bedclothes, gets into the air in the form of dust, and so is inspired by the attendant." It is admissible to apply this to a convalescent, as well as to a patient; and although we do not suppose that the British soldier is dirty and careless in his habits (like the Boers in Ceylon, p. 602), still, there is no doubt that fæcal and urinary dust may be present on clothing and blankets, &c., used by enteric convalescents; which, when disseminated throughout the ill-ventilated casemate, would constitute a distinct danger to the occupants.

In this instance, therefore, contrary to the Indian instances above related, the balance of probability appears to incline towards a genuine direct contagion of the immediate surroundings of the patients (*i.e.*, convalescents) as the mode of propagation.

"The second group of cases numbered eight, who were admitted between July 20th and September 17th. Fourteen days elapsed between the admission of the first and of the second case, and again fourteen days between the second and third cases; the rest came in at short intervals." The first, and probably the second, were infected while in camp, away from Portland. On return to the station they occupied rooms in the south-east casemates; on the admission of the second case these casemates were again evacuated; six cases were admitted after this, of which three had become infected in the south-east range, and a fourth had slept in the next bed to one of the others. The same mode of propagation must be held to be the most probable one in this series as in the former; the general sanitary conditions as regards water, food, &c., were unchanged.

Statistics are not yet available as to the exact number of men who arrived home from South Africa convalescent from enteric fever; the total number of cases of enteric in South Africa during the war was, in round numbers, 31,000, of whom 6,000 died; of those who recovered, numbering 25,000, the majority must have come to England for a time or permanently. They were scattered in garrisons and regimental depôts all over the country; nevertheless careful enquiry failed to detect any outbreak that could be traced to infection derived from these convalescents, with the one exception just related; the single case at the Curragh in 1900, and the three cases at Dover in 1902, serve but to emphasise the rarity of infection in this manner.

Moreover, if we turn to the experience of civilian hospitals, we find, on the whole, that direct infection is very rare. Out of ten of the great general hospitals in London, only one isolates its enteric patients; all of these nine hospitals have enteric cases continually under treatment in the general wards: it is true that the most careful precautions are taken to prevent carriage of infection from patient to patient, or from patient to nurse; and regulations, or customs, are in force that prevent the aggregation of too many cases of fever in one ward; these vary in the different hospitals, but as a rule not more than one, or two, beds in a ward of twelve to fifteen beds, are allowed to be occupied by enteric patients. The restriction, however, is operative only in regard to acute cases; when the acute symptoms are over (fever, diarrhœa, &c.), the patient is bathed and disinfected, and after this is not considered as of any account as regards the restriction; so that two or more convalescent cases might still be in a ward as well as the regulation one or two acute cases. The restriction is really not so much on account of any idea of danger to the rest of the ward, as from a desire not to lay too great a burden on the nursing staff; infectivity through alvine and urinary excreta continues, of course, long after acute symptoms have subsided.

From the experience of these hospitals a fairly wide induction may be drawn as to the danger or safety of this practice. As regards transmission of the disease from patient to patient, there is little definite evidence; no such cases have occurred of late years at Guy's, Charing Cross, Westminster, St. George's, the London or St. Bartholomew's Hospitals. At one hospital there have been four such cases, at another one, at another six, during the last five or six years; at another, only one case during twenty years.

As regards transmission from patient to nurse, there is more evidence. At only two hospitals have there been no instances during recent years; at the remaining eight cases of infection have occurred, varying in number, but approximately about one every year in each institution.

At the Metropolitan Asylums Board Hospitals, continuing Dr. Goodall's statistics already referred to, there have been altogether 180 cases among the hospital staffs during the twelve years, 1892 to 1903, inclusive. During this period 11,132 cases of enteric fever have been admitted to these hospitals. During the eight years, 1896-1903, for which detailed statistics are available, 143 cases of enteric fever have occurred amongst the hospital staffs; of these 127 have been amongst nurses or ward maids (presumably

mostly employed in the enteric wards). At the South-Western Hospital during nine years, 23 members of the staff contracted enteric fever, all were nurses; the proportion of nurses employed in the enteric wards to those employed in other wards was only as one is to fifteen; nevertheless, all of these enteric cases, except one, were nursing in the enteric wards.

In the fever wards of the Nottingham General Hospital, where from 100 to 150 cases of enteric are treated every year, Dr. Handford informs me that some 30 cases have occurred amongst the nursing staff during the last twenty years while engaged in the enteric block.

IV.—Conclusion.

We may now review the evidence that has been brought together as to direct transmission of the enteric infection.

(*a*) From patients in hospital to other patients: (1) According to the experience of the London general hospitals this is extremely rare, not accounting for more than one or two cases a year throughout London. (2) According to the experience of military hospitals in England, it is rare, accounting for only 1·34 per cent. of the total admissions (19 out of 1,410 in eleven years).

(*b*) From patients in hospital to nurses: (1) In the London general hospitals this occurs, in spite of all precautions, though not to any great extent: nevertheless nearly every London hospital has about one such case nearly every year. (2) In military hospitals in England this accounts for 2·62 per cent. of the admissions, the "nurses" being orderlies in attendance on the enteric cases. (3) The Metropolitan Asylums' Board statistics show that 127 cases have occurred amongst the nursing staff during the last eight years.

(*c*) Direct infection has been shown to be the most probable cause of spread in a small outbreak at Portland Barracks.

(*d*) A considerable body of skilled opinion, that of some of the most experienced Medical Officers of Health in this country (Dr. Handford, Dr. Alfred Hill, Dr. Niven, Dr. Priestley, Dr. John Robertson and others), exists, to the effect that a notable proportion of cases (one-tenth to one-seventh of the total number) owe their origin to this mode of infection.

(*e*) As one result of the very careful inquiry into the huge epidemic amongst American troops in 1898, in which there were more than 20,000 cases of enteric; of 1,608 cases specially investigated, 35 per cent. were found to be directly connectable attacks, and 27 per cent. in addition to be indirectly connectable.

The current authoritative teaching at the present day, as gathered from the most widely read text-books, is as follows :—

In Fagge and Pye Smith's "Text-Book of Medicine," fourth edition, it is stated that "direct contagion from one patient to another is unknown, or excessively rare" (p. 139). Again, "Conveyance of the fæcal contagion by the air is extremely doubtful, although it was believed in by Fagge, by Gaffky, and by Dr. J. W. Moore" (p. 141).

Dreschfeld, in Clifford Allbutt's "System of Medicine," sums up by saying: "The facts ascertained . . . are, briefly, that in very few cases is there any evidence of direct contagion from the sick to the healthy" (p. 804).

Dr. F. Taylor, in his "Manual of the Practice of Medicine," seventh edition, 1904, says: "It is very doubtful if anything is given off from the body or the breath of the patient to the surrounding air which can convey the disease to another individual. As a rule, doctors, nurses and students in hospital do not take enteric fever directly from the patients. The agent of transmission is, in the vast majority of cases, the fæces; and in those not very common instances in which nurses have contracted the disease from their patients, it was probably by direct contact with linen or bedclothes soiled with the fæcal discharges. . . . It is now generally believed that enteric fever is rarely, if ever, conveyed directly by the air. . . . In the Transvaal War it appears likely that fæcal infection was assisted by sand storms and flies (Tooth). . . . The fact that the urine, in some cases, contains typhoid bacilli in great numbers renders it possible that this secretion is sometimes responsible for the transmission of the disease" (pp. 39, 40).

Sir Wm. Broadbent, in Quain's "Dictionary of Medicine," 3rd edition, 1902, says :—"Typhoid fever is not commonly disseminated from person to person. Medical men, clergymen and others visiting those who are suffering are not attacked, nurses very rarely, when proper precautions are observed. If, however, bedclothes, or carpets, soiled by the evacuations, are not removed and disinfected, and still more when gross neglect of cleanliness and decency is permitted, attendants will contract the disease."

Osler, in his "Principles and Practice of Medicine," 4th edition, 1901, adduces twenty cases that had occurred amongst the staff of the Johns Hopkins Hospital during the preceding twelve years, 7 being patients and 13 attendants; he admits that "the possibility of direct transmission through air from one person to another must be acknowledged, although, as shown by Germano, when *completely* dried in air currents the specific bacillus quickly dies" (p. 5).

As to the importance and relative frequency of infection by direct contact, the views of these authors (except Osler) are evidently diametrically at variance with those of Koch and his fellow-workers; and it is submitted that sufficient evidence has been adduced from recent experience to justify greater prominence being given to this mode of transmission in the authoritative medical teaching of the day.

Koch, however (be it said with the utmost respect), appears to attach too great importance to actual *direct* transmission. The contact epidemics described (as, *e.g.*, at Sarrebrück) may have been due in part, as was almost certainly the case in many Indian instances, to *indirect* transmission through infected latrines, or to infected soil, dried and disseminated as dust. Moreover, it is difficult to accept the "obligatory human" parasite view of *B. typhosus* in face of the experimental proof as to its viability outside the body. Even if the earlier observations cannot now be relied on as demonstrating a genuine *B. typhosus*, those of J. Robertson (1897), who recovered the bacillus from soil after eleven months; and those of Firth and Horrocks (1902), who demonstrated its presence, with the strictest possible tests, after two and a half months in polluted soil, show that, although water and food may be excluded, direct contagion is not the only alternative. While, therefore, on the one hand, we cannot any longer consider contagion from a typhoid patient direct to a healthy person to be either "unknown or excessively rare"; on the other we must allow that the specific bacillus is not invariably "obligatory" to man; and although it is rarely actually found in water, that water is the medium of its widest dissemination holds good now, as always, when the necessary conditions are present. The Lincoln outbreak of last January, with its 500 cases, is a timely reminder that after all water is, on occasion, the most potent cause of epidemic spread under the ordinary conditions of life. In campaigns, with faulty sanitary conditions that are partly inevitable, the American experience shows that contact is still more potent as a cause.

It has been said above (p. 597) that we have no reason for doubting the statements of Murchison and others as to the absence, or extreme rarity, of cases of infection from patient to patient, or from patient to nurse, during a long period of years, up to about 1870. Since 1890 a large body of evidence has accumulated in the opposite direction. What is the explanation? It may be that a change has taken place in the nature of the disease, so that it is now more infective than it was a generation back; or it may be that a change has taken place in the bodily constitutions of the persons exposed

to infection, so that the present generation is more receptive of infection than was formerly the case.

(1) As to change in the nature of the disease, there is nothing unreasonable in the supposition: the essential cause is of course the specific bacillus; but not only may variation have occurred in the organism itself, in the direction of either intensification, or of attenuation of virulence, but permanent, or quasi-permanent, varieties may have branched out from the original type, which may vary in *their* virulence; these are, in fact, known to exist (para-typhoid varieties), giving rise to para-typhoid infections. The variableness exhibited by the clinical features of what is called enteric fever is so great, no one of the classical pathognomonic symptoms being constantly present, that it is quite natural to suppose that the infectivity is also very variable in quantity: *e.g.*, a case with prominent and characteristic diarrhœa may be more infective than one with "coach-paint" stools.

(2) As to change in the bodily constitution of persons exposed to infection, this is also quite likely to have taken place. With regard to the much greater incidence upon nurses nowadays than formerly, there can be little doubt that the explanation put forward by Dr. Collie in 1879 will account for this to a great extent; formerly nurses were, as a rule, middle-aged; now they are, as a rule, young, and therefore more susceptible. This explanation cannot, however, hold good in regard to the direct transmission theory all round. There is another explanation which seems to be very reasonable. (i.) During the last thirty or forty years a vast improvement has been effected in the sanitary condition of the country as a whole, and especially in town districts; of this there can be no doubt. (ii.) One of the results of this has been a great reduction (on the whole) in the mortality of infants and young children. (iii.) Though not always recognised, it is now understood that young children are very susceptible to enteric fever: in the German anti-typhoid campaign especial attention was paid to this point (p. 591). (iv.) A large part of the reduction in infantile mortality is therefore probably due to lessening of the typhoid incidence amongst young children. (v.) It follows, therefore, that under the improved sanitary conditions of the last thirty years a generation has been growing up materially differing, *quâ* typhoid susceptibility, from the preceding generation; formerly many infants and young children were infected, some died, some survived with more or less immunity to subsequent infection; now a large number grow up without having secured that partial protection, and the general young adult population are accordingly more liable to suffer. That immunity may result from

long residence under insanitary conditions is well known; witness the inhabitants of the delightful but dirty cities of the south of France, Italy and the Levant. They may have had a regular attack of enteric fever in childhood; or they may have taken in continuous minute doses all through their early lives and become immune; an English man or woman runs the greatest risk when coming to live under like conditions. So in India and the East generally; the adult native populations are to a great extent immune, probably because they have all been exposed to the infection since infancy; many have died from "fever," the survivors are protected. The British soldier comes into relation with this population, and having nowadays been brought up in comparatively healthy surroundings, naturally falls a victim to conditions which to the native resident are harmless.

Making every allowance for faulty diagnosis in the earlier days that have been alluded to, there seems to be good ground for believing that a change may have taken place, both in the nature of the disease and in the constitutions of the persons exposed to infection; which two things together will naturally account for the altered conditions that undoubtedly exist. Although it might be going too far to assert that this is the true, or the only, explanation, it provides a working hypothesis on which to act. The following measures are suggested:—

(1) A general recognition of the fact that direct contagion in enteric fever not only exists but is an important factor in the spread of the disease; the fact is well-known, but the recognition of it is not *general*, and for this the teaching of the text-books is largely responsible.

(2) Following on this, an increase in the precautions taken in the routine treatment of cases, not only in hospital, but still more in private houses.

(3) The carrying out of Koch's "stamping out" method, wherever and as thoroughly as possible; the cardinal points being detection, notification, isolation and disinfection.

(4) Nevertheless there should be no relaxation in the supervision and examination of water supplies and food supplies, or in the general sanitary measures for the rapid removal and complete disposal of excrementitious and other refuse.

NOTE.—It should have been stated on page 602 that the dissemination of enteric fever at Diyatalawa, by flies and through air, was demonstrated by Colonel (now Surgeon-General) R. H. Quill, R.A.M.C., in a contribution to *Army Medical Department Reports* for 1900.

RESEARCHES ON MALARIA.

By Major RONALD ROSS, C.B., F.R.S., D.Sc.
Indian Medical Service (R).

(*Continued from p.* 579.)

(20) *Calcutta: November,* 1898—*February,* 1899. *The Work Confirmed.*—Arriving at Calcutta on November 19th I set to work to pick up the threads of my work on "Proteosoma"; to obtain cases of human malaria (the plague-scare having abated), and to write my report on *kala-azar*—this being a tedious business requiring a full discussion of many intricate details. But my health had now suffered greatly from the continuous exertion made under very trying circumstances; and I felt scarcely able to complete even my report. The labour, the disappointments, even the successes, of the long and anxious investigations of a single subject had been too much for me.

The cold and dry weather had now commenced in Calcutta, and the result was that the malaria parasites had become much more difficult to find, either in men or in birds. Added to this, as I had no room in my laboratory which could be warmed by a wood fire (a gas-stove injured the insects), the mosquitoes could scarcely be persuaded to bite, and when they did so, it was observed that the parasites developed in them much more slowly than in hot weather.

Moreover, all this time I had failed to obtain any assistance in India, and saw no prospect of obtaining any. I had been told, indeed, by Manson, that Dr. Daniels was to arrive shortly; but he was being sent, not really to assist me, but to enquire into the correctness of my statements; and was to remain with me only for a month or two. The only persons who had hitherto taken sufficient interest in my proceedings even to look at my preparations (I mean from the beginning of my work in 1895) had been Drs. Smyth, Maynard, Dyson, and Cooke, and it was clear that no one really credited my results. Even the Director-General, who was then in Calcutta, would not visit my laboratory. It was the case of Galileo and the satellites of Jupiter over again!

I was, however, much cheered by the arrival of Dr. Rivenburg of the American Mission, who, hearing of my work, came all the way from a distant part of Assam with his wife and children, at his own expense, to assist me. He had been previously quite unknown to

me ; and I shall never forget his disinterested action and the help he gave me.

I had also been delighted to hear from Manson that the work was now being taken up by Kock and the Italians. My papers had been published as described ; copies of my "Proteosoma" Report [42] had been sent to many persons interested in malaria. On November 8th Manson wrote again informing me that he had just despatched some of my preparations to Rome, namely, to Bignami and Charles.

I did not become acquainted with the admirable work of Koch until later (section 23) ; but the efforts of Bignami and Grassi were now communicated to me in a series of interesting and well instructed letters by Dr. Edmonston Charles—a gentleman then staying in Rome, but whom I had never met, nor corresponded with before. From these and their own papers it was clear that the Italian writers had been inspired by my work, and had been desperately endeavouring to follow it; that they had detected the genus (*Anopheles*) of my dappled-winged mosquitoes, and after having seen my preparations, had succeeded at the end of November in finding my pigmented cells in an Italian species of this genus caught in infected houses. Bignami also claimed to have infected healthy persons by mosquitoes obtained in this manner ; and, by a lucky stroke, one of the persons bitten by some *A. claviger* was found to have acquired the mild tertian parasite.

I shall return to this subject when describing the confirmations of my work. The efforts of Bignami and Grassi were, however, obviously hasty and unreliable, while their writings were historically most inaccurate. They therefore did not impress me, and exercised no influence whatever in the completion of my own labours. For several years afterwards, however, nearly all my work was credited to these writers.

One interesting fact, however, I learnt from the Italians through Charles, namely, that my grey mosquitoes belonged to the genus *Culex* and my dappled-winged mosquitoes to the genus *Anopheles*. Manson appears to have sent some of the former to Grassi, and, according to Charles's letters of November 19th, he thought they were *Culex pipiens*—as a matter of fact they were *C. fatigans*. Also from Charles's letter of November 25th and from their own publications [48, 51], it was clear that the Italians thought that my dappled-winged mosquitoes were *Anopheles claviger ;* and in his letter of January 6th it was stated that Grassi considered some dappled-winged mosquitoes which I sent him were *A. pictus*—they were really *A. rossi*, Giles. I satisfied myself more fully next year

at the British Museum regarding the zoological names of the mosquitoes studied by me. The Italians had no difficulties in these respects, as they had Ficalbi's works on gnats to guide them. They received some more of my preparations, through Dr. Charles, early in January, 1899.

On December 22nd Dr. Daniels, of the Medical Service of British Guiana, arrived. Though somewhat sceptical at first, he was soon convinced after seeing my preparations and repeating the experiments with care; and he fully confirmed my work in a paper, which, however, was not published by the Royal Society until much later [71]. I am much indebted to him for his assistance and advice in connection with my report on *kala-azar*—no one has a profounder knowledge or a larger experience of malaria. In the time remaining to us we attempted several series of experiments on human malaria (cases now being more obtainable), mostly with the large brown dappled-winged mosquito of Calcutta, with which I had made most of my few but negative experiments recently in Calcutta and Assam. These, too, proved to be negative. We ascribed our failure to some mistake; but the cause was ill-fortune. The mosquitoes were chiefly *Anopheles rossi*, which in Bengal certainly do not easily take malaria.[1]

At this time I informed Daniels of some other details; and, in view of a controversy which arose later, he has kindly testified to this fact in the following letter:—

Dear Ross, *October* 8*th*, 1900.

I shall have great pleasure in testifying to the following facts:—

(1) Shortly after my arrival in Calcutta in December, 1898, you showed me living specimens of your "grey," "brindled," and "dappled-winged" mosquitoes.

You pointed out to me the attitude assumed by the last, the position of its larvæ in water, and the peculiarities of its eggs.

Since then I have learnt that these are characteristics of the genus *Anopheles*.

You contrasted these with the eggs and larvæ of other mosquitoes, which I now know to belong to the genus *Culex*.

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[1] It was, of course, the cold weather in Calcutta, but Daniels and I used incubators. Stephens and Christophers later obtained positive results in Nagpur with *A. rossi*, but only by very careful artificial regulation of the temperature [71].

It should be clearly understood that all my experiments on human malaria since 1897 were made under very unfavourable circumstances, and that I never considered my negative results to be at all final.

(2) You showed me two species of "dappled-winged" mosquitoes, and I sent specimens of them to the British Museum where they now are. They have been described by Major Giles, I.M.S., as *Anopheles*.

You also showed me a specimen of a stomach of a mosquito with what are now known as "zygotes." This you stated was the stomach of a "dappled-winged" mosquito, similar to those you had shown me, which had been fed on a patient with crescents in 1897.

(3) I may add that the development of Proteosoma, as demonstrated to me by you in the "grey" mosquito, is essentially the same as the development of "crescents" in *Anopheles* as observed by me in British Central Africa.

I am,

Yours very truly,

C. W. DANIELS.

P.S.—As regards breeding-places, you informed me that the "dappled-winged" mosquitoes breed in puddles, the "brindled" mosquitoes generally in flower-pots, and the "grey" mosquitoes in tanks, ditches, &c.

C. W. DANIELS.

Major R. Ross.

Several distinguished visitors came to us at this time—F. Plehn, A. E. Wright, and A. Ruffer. They all accepted our work, except the "black spores" mentioned in section 17. Nevertheless, Daniels and I did not think it right to abandon them without clear evidence; but when, later, I found closely similar bodies in large numbers in mosquitoes which had not been infected at all, my faith was shaken, and it was disturbed still more when I failed to find them in the infected mosquitoes of Sierra Leone. My doubts were mentioned in the concluding sentences of my report on *kala-azar*.

That report was finished on January 30th [79], and contains eighty-one closely printed folio pages. My year's special duty was now almost finished; but I could obtain no definite assurance from my chief that I was to be retained on the same duty for an extended period. Yet the matter was vital to me. Nearly all the money at my disposal had been spent in consequence of these researches, chiefly because of the expenses connected with the constant changes of station to which my family and myself had been subject; and if I were now compelled to return to Secunderabad, I should not be able later to pay for my passage to England. Moreover, both Daniels and Rivenburg were now leaving me, and it was evidently foolish to expect any further assistance in India—much more that of a trained entomologist, which I especially required for the completion of my work on

human malaria. I therefore determined to leave India forthwith and to return to England, trusting to fortune to give me an opportunity for finishing the investigation in a manner which I thought suitable. I mention these personal details as I have been blamed for leaving India at that moment.

Before doing so, I urged upon Government the importance of taking active measures for the prevention of malaria in accordance with my observations. Besides advising the strict use of mosquito-nets for a personal prophylaxis, I urged especially a campaign against mosquitoes as the best measure for towns and cantonments, particularly against the dappled-winged mosquitoes, which I said breed principally in water on the ground. My letter was published later [55], and I hope that the advice will soon begin to be taken.

I had also written a brief abstract of my work dated December 31st, 1898. This was presented by Laveran to the Académie de Médecine on January 24th, 1899, and was published soon afterwards [54]. In this paper my obligations to Manson and Laveran were acknowledged, I hope, in the full manner which honourable science demands. I wrote :—

> " Pour éviter tout commentaire erroné, qu'il me soit permis de déclarer ici que mes travaux ont été entièrement dirigés par Manson et que j'ai eu l'assistance de ses conseils et de son influence à tout occasion ; je dois aussi remercier le Dr. Laveran de m'avoir envoyé ses avis si autorisés. Quand, en mai dernier, je lui envoyai des spécimens de mes corps pigmentés du moustique, il reconnut immédiatement la vraie nature de ces éléments."

And I added in conclusion,

> " Je considère comme probable que la malaria est communiquée à l'homme uniquement par les morsures des moustiques et peutêtre d'autres insectes."

(21) *England ; March—July,* 1899. *Foundation of the Liverpool School of Tropical Medicine.*—On the voyage to England (February, 1899), I had full time to consider the present condition of our knowledge about malaria, especially in relation to the all important subject of prevention. It was almost certain that infection is caused solely by the bites of insects—but of what insects only ? My long negative work had almost proved that the commonest Indian mosquitoes, the grey and brindled genera, do not carry æstivo-autumnal infection, at least. On the other hand, it was certain that two species of dappled-winged mosquitoes in Secunderabad, and one species in Rome, do carry it ; while, if

Bignami's observation was to be trusted, the last species carries also the mild tertian infection. But Secunderabad and Rome are not the whole world: even in Bengal, Daniels and I had not succeeded in infecting dappled-winged mosquitoes. The question as to which species do or do not carry malaria might prove to be a very complex one, not to be solved only by a few local experiences; there are probably hundreds of species of mosquitoes in the world, each of which would have to be tested unless we could find some good reason for limiting the enquiry. I therefore sought for some such reason, and found one. For centuries it had been known that malaria is connected with stagnant water on the ground —not with water in the pots, tubs, and tanks which abound close to all habitations, but with marshes and pools on the surface of the earth. Again, malaria was known to increase every year at the rainy season, and subsoil-drainage was known to mitigate if not remove the disease. Hence *it was extremely probable that the insects which carry malaria breed only, or chiefly, in terrestrial water*. For years we had assumed that the disease is caused by organisms which spring from marshes. We had been partially right, but not wholly right; it is not the infective but the infecting organism which springs from the marsh—not the germ but the carrier of the germ. Now, referring to mosquitoes alone, which varieties of these insects breed only or chiefly in terrestrial waters? I remembered my frequent observations on this point (sections 14, 15 and 19). The grey and brindled mosquitoes breed chiefly in tubs and pots in India, but *the dappled-winged mosquitoes breed in pools on the ground*. Now it was only these last which, hitherto, had certainly been connected experimentally with malaria.[1]

What a weapon for good was now placed in our hands! Hitherto when we wished to remove malaria we were obliged to drain a whole area, recognising only that all terrestrial waters seem to be dangerous. Now we should be able to go to a place and to point out the actual pools which cause the disease, by showing that they contain the larvæ of the culpable insects. The expense of dealing only with these would be much less.

Shortly after my arrival in England in March I learnt something about the zoological classification of mosquitoes from Mr. E. E. Austen, of the British Museum. I found that, as I had already

[1] This reasoning was by no means obvious or even known until after our work at Sierra Leone. In temperate climates grey mosquitoes (*Culex*) also breed often in terrestrial water.

partially learnt through Charles, my dappled-winged mosquitoes were those of Meigen's genus *Anopheles*, and that both my grey and brindled mosquitoes belonged to the same genus, namely, *Culex*. I was dissatisfied with this because it seemed to me certain that they were of different genera. Recently Theobald, in his fine work on mosquitoes [75], has separated them, placing the brindled mosquitoes in the genus *Stegomyia*, and reserving the name *Culex* for the grey mosquitoes. Later, Giles determined that the grey mosquitoes which carry *Proteosoma* are *Culex fatigans*, and called the large negative dappled-winged mosquitoes of Calcutta *Anopheles rossi*.[1]

Meanwhile Manson had been urging his great scheme of creating special schools for the teaching of tropical medicine, and had now received the support of Mr. Chamberlain. In Liverpool Sir Alfred Jones, supported by Professor Boyce, of University College, Mr. Adamson, Chairman of the Royal Southern Hospital, and many other gentlemen, had warmly taken up the scheme, and now appointed me the first lecturer of the Liverpool School of Tropical Medicine. I therefore found myself no longer an isolated worker, but a member of a company determined to advance the interests of life and health in the Tropics. And it was an auspicious moment, for the great weapon which had just been forged for the prevention of the most important of tropical diseases needed strong hands to lift and wield it.

Almost my first care on returning to England was to consult eminent zoologists regarding the proper nomenclature for use in connection with the developmental stages of the parasites in mosquitoes. With the aid of Professor Herdman I published a paper on the subject [59], in which, abandoning the hasty provisional nomenclature hitherto used by me, I called the motile filaments *microgametes*, the pigmented cells *zygotes*, and the thread-like bodies *blasts*. I also suggested a classification for the parasites of men and of birds. But there is still great divergence of opinion on these subjects.

Evidently West Africa, a rich and enormous country hitherto paralysed by malaria, was destined to be the first objective. I lost no time in urging the advisability of sending me there in order to complete my studies of the disease and determine its agents on the spot. In July I delivered my inaugural lecture, and demanded

[1] Owing to an error he thought that it was this kind in which I had first found the pigmented cells in 1897.

attention for my scheme for extirpating malaria by attacking the pool-breeding mosquitoes [58]. At the end of July, 1899, accompanied by Mr. E. E. Austen, of the British Museum, and Dr. H. E. Annet, Demonstrator of the Liverpool School of Tropical Medicine, I left England for Freetown, Sierra Leone.

(22) *Sierra Leone, August—September*, 1899. *The Investigation Completed.*—We have now reached the last chapter of this history, which I fear has become tedious. If a literary simile may be allowed in a scientific narrative, I had at least come to my Ithaca, after many mischances sent by many opposing deities. Two years had elapsed since I had seen the pigmented cells of the human parasites —two years of fruitless efforts, interruptions and bad fortune, and seven years had elapsed since I had commenced the special study of malaria; but now, assisted by my able colleagues and myself, I needed but a week or two to demonstrate all the stages of the human parasites in dappled-winged mosquitoes, and also to ascertain the fundamental principles upon which State sanitation against tropical malaria should be based. I will be brief; the details are given in the publications [60, 67].

On the day after landing (August 10th) we found two species of dappled-winged mosquitoes (*Anopheles costalis*, Loew, and *Anopheles funestus*, Giles) in abundance. On August 13th we detected a pigmented cell, evidently of the mild tertian parasite, in one of them. A few days later, in some barracks where there was much malaria, we ascertained that a quarter of the mosquitoes (almost exclusively *A. costalis*) were infected, and found in them pigmented cells evidently derived from all three varieties of parasites—quartan, tertian and æstivo-autumnal. We also made a few formal feeding experiments, and could have made as many more as we pleased. The material was unlimited; but our time was short and the proof was already sufficient.

We then investigated the conditions under which the *Anopheles* breed and propagate malaria. It was the rainy season and the place was full of stagnant pools. Everywhere the larvæ of the dappled-winged mosquitoes were in these pools, while those of the grey and brindled mosquitoes occurred in tubs and pots. The great law of malaria—its connection with stagnant water on the ground—was explained. Moreover, simply by noting the presence of the larvæ, we could tell at a glance which pools were dangerous to health and should be dealt with in the public interests.

The habits of the insects were noted and found to be precisely similar to those of the Indian species. We studied particularly the

characteristic attitude of the larvæ and adults of the dappled-winged mosquitoes, as formerly observed in India—invaluable tests for the immediate and easy recognition of the agents of the disease; we noted the evidence demonstrating the short flight of the insects and their connection with rank tropical vegetation; we disposed of the ideas that tidal swamps cause malaria, but showed how earthworks produce outbreaks by the formation of pools of rainwater. In fact, we were able to give a thorough explanation of the manner in which the old paludic and telluric theories of malaria originated.

We were also able to establish for the first time the fundamental principles which the State must adopt in order to extirpate malaria in tropical cities. These are (*a*) scrupulous drainage of the soil; (*b*) pending this, the persistent treatment of *Anopheles*' breeding-pools by culicicides; (*c*) the segregation of Europeans. We also recommended the protection of public buildings, such as barracks, gaols, hospitals and rest-houses, by wire gauze screens; the isolation of the sick, and the habitual employment of mosquito-nets and punkahs by individuals.

Our results and recommendations were immediately communicated to Government and also published in the medical press [60].

After our return to England in October we published a full report of our experiences [67]. In this book, written by myself and endorsed by my colleagues, I collected the principal results of all my researches on malaria made during seven years; and illustrated the life-history both of the human and avian parasites in mosquitoes by numerous photo-micrographs made by myself. This work, therefore, which records the completion of these labours by the successful demonstration of the whole evolution of the human parasites in *Anopheles*, constitutes the summary and conclusion of all my previous papers. It has been said that the book was based on the writings of those who, as a matter of fact, learnt everything from me; but I can say with exact truth that if no one except MacCallum and Koch had touched the subject since 1895, scarcely a word in the Report would have been different.

It should be added that in March, 1900, I gave an abstract of the history of my work in a lecture at the Royal Institution [68]; and particularly that toward the end of the same year the President of the Royal Society, Lord Lister, formally accepted my results in his address to the Society.

From this time my own efforts have been devoted almost entirely to the practical campaign against malaria. Few people are aware of the fact that even the most solid discoveries of science may be

allowed by the public to remain quite disused and inoperative unless strenuous efforts are made to urge them upon the popular attention. Even yet, in spite of the constant endeavours of many persons, very little has really been done towards the extirpation of malaria. This has been principally due to the fact that, for some inexplicable reason which wholly escapes me, the chief prophylactic measure recommended by me, namely, a campaign against mosquitoes by drainage and petrolage, has been generally held to be impossible; yet it is the only general prophylactic measure possible in tropical towns. The struggle over this matter has been almost as severe as that over the original problem; but it is now drawing to a close. It is impossible to discuss the matter here. Suffice it to say that in the two principal towns, Havana and Ismailia, in which the measure has been adequately employed, the reduction of malaria has already been as much as 80 per cent.

This then is the conclusion of the history. I fear that some of the personal details may have appeared out of place in the narrative; but they have been introduced—though unwillingly—for a special reason. No form of enterprise is of such transcendent importance to humanity in general as the investigation of disease—the principal enemy of every man. The interests of all nations, not only in the present but in the future, demand that every possible encouragement should be given to such investigations—particularly that medical men, who are in an excellent position to undertake them, shall receive the warmest assistance in their self-imposed task. The story, however, which I have felt it a duty to record in this lecture, adds but one to the many instances of medical history which show that little attention is given to this point. My labours will be abundantly repaid if earnest students in this field of science receive in the future, in consequence of this narrative, a little more assistance than was given to me.

(23) *Confirmation and Extensions.*—It is impossible for me to describe here, even in detail, the vast amount of work which has been done in many parts of the world on the mosquito theory of malaria since 1899; but it is necessary just to touch upon some of the more immediate verifications of my observations.

(*a*) Undoubtedly the first verification was due to Koch and his assistants [63, 64]. Professor Koch was kind enough to communicate to me, at my request, in a letter dated May 15th, 1901, the origin and progress of his researches on the mosquito theory of malaria. He says:—

"The idea that mosquitoes may be the cause of malarial infec-

tion occurred to me on my first visit to the Tropics in British India in the winter of 1883—84, and since then I have always spoken in this sense in my lectures and to my assistants. I have not, indeed, myself published anything about these views; but you will find a notice in R. Pfeiffer's work, *Beiträge zur Protozoen-Forschung*, Berlin, 1892 (near the end).

"The fact that malaria, when it occurs epidemically, is often confined almost entirely to the children, the adults remaining free and therefore having become immune, I discovered first in villages in Java which lie in the valley of Ambarawa. That was at the beginning of November, 1899. I reported on it on December 9th, 1899, and my letter was published in the *Deut. Med. Woch.*, No. 5, 1900, beginning of February. I obtained my first successful cultivation of *Proteosoma* in mosquitoes in company of Prof. R. Pfeiffer, in Rome, in September, 1898. We continued the investigation in Berlin; and in the middle of November we followed the developmental stages of the parasite up to the sickle-shaped bodies in the poison glands of the mosquito—that is, up to the end. We were able to determine the form of *würmchen* (vermicule) in *Proteosoma* so easily because I, with Professor Kossel, had already in June of the same year (1898), without knowledge of MacCallum's investigation, detected the origin of the spermatozoa, the process of fertilisation, and the formation of the *würmchen* in *Halteridium*.

"The publication of this investigation was very much delayed in consequence of the long time taken for the reproduction of the photographs in a way which satisfied me.

"At all events, I have not thought it necessary to attempt to assert my priority on this occasion, as the matter concerned only the confirmation of already known things."

Professor Koch has the honour of having been one of the first, not only independently to conceive the mosquito theory of malaria, but also to attack it by experiment. He and Kossel independently observed the function of the motile filaments by the employment of correct methods of staining; this is practically admitted by Bignami (*Lancet*, 1898, vol. ii., p. 1898), who was later able, probably through his instruction, to demonstrate the chromatin in the motile filaments [50] — a thing which he had refused to credit before. Koch also was the first to fill a gap in my own researches on *Proteosoma* by demonstrating the passage of the vermicule through the wall of the mosquito's stomach—a subject in which Grassi merely followed him later. That he succeeded in cultivating *Proteosoma* in Rome and Berlin, in September to November, 1898, shows that

he was the first to confirm my own observations. About that time Dr. Annett, of the Liverpool School of Tropical Medicine, saw some of his preparations of pigmented cells in Berlin. Koch's discovery of the frequent infection in native children in the Tropics was one which I had entirely failed to make—although I should have made it; and is an addition to our knowledge of the very highest importance, being of far greater intrinsic value than much of the trifling matter which has been put forward in other quarters with much *réclame*. It enables us to explain with ease the source of most malarial infections in the Tropics, and, besides, gives a complete revelation regarding the possibility of immunity in malaria, a thing in which no one would previously believe. Added to this, Professor Koch has pressed still further onwards, and pushed with authority and ability the great subject of the practical prevention of the disease in the Tropics—a matter the importance of which few writers on the subject have seemed able to comprehend. The methods recommended by me consist principally of the use of mosquito nets and the extirpation of mosquitoes; but Koch at once inaugurated a new conception which had not occurred to me, and which consisted in the cinchonisation of the people in malarious localities. Although this measure is not always possible in its full extent, still experience shows that in a modified form it is most useful; and I have come to the conclusion that it should always be enforced as much as practicable in addition to the measures which I advocate. It was also Koch who was the first to call general attention to the important fact that a sudden and ill-advised dose of quinine is apt to precipitate attacks of blackwater fever in certain persons and localities.[1]

(*b*) Many erroneous ideas have been formed about the Italian work (referred to in section 20) by those who have no practical knowledge of malaria or full acquaintance with the literature. The facts are exactly as follows:—

The South of Italy affords unparalleled advantages for the study of malaria, because abundance of material is there combined with great facilities in connection with laboratories, literature and scientific communion; hence, though the principal discoveries have been made elsewhere, the writers of Southern Italy have been able to add to them much detail, which has proved more or less correct. It was hoped after Laveran's discovery that they would be able to

[1] I should like to add, in contradiction of many inaccurate statements which have been made, that his acknowledgment of my own observations has been the most complete possible.

find the extracorporeal phase of the parasite, but unfortunately, misled by fondness for hypotheses, they fell into fundamental errors. Most of them hastily concluded that the motile filaments are "agony-forms," and, as described in sections 6 and 11, A. Bignami rejected Manson's induction on this account, and another writer, G. B. Grassi, abandoned the whole mosquito-theory (i.) because mosquitoes do not bite birds; (ii.) because they abound in places where there is no malaria, and (iii.) because the malaria parasites die in the stomachs of mosquitoes. At the same time he maintained that the extracorporeal stage of the parasite is a free-living amœba [10]. Bignami, however, while rejecting Manson's version of the theory, adopted King's, and stated that he had even made some experiments on the subject in 1894, but these were only referred to as a past event [29], and seemed to have been quickly abandoned.

It is probable that these writers would have remained indefinitely in this position but for the researches of others. In 1895—97 Sacharoff [23], Simond [35], MacCallum [36], and myself [32] destroyed the Italian theory regarding the motile filaments, and then the publications of December 18th, 1897 [38], February 26th, 1898 [39], May 21st [42], June 18th [41], September 24th [43] and October 11th [46], completely demonstrated the life-history of this group of parasites in mosquitoes, clearly indicated the genus concerned in the propagation of æstivo-autumnal fever, and gave other details mentioned in section 17.

As all these papers, except those of May 21st and October 11th (which were in fact covered by Manson's papers of June 18th and September 24th), were published in such a prominent organ as the *British Medical Journal*, it is to be assumed that they were from the first known to the Italian writers, who have always shown a prompt knowledge of the labours of others. In his first publication [44] Grassi refers to my work without mentioning my name or giving references—as if it were then perfectly well known in Italy. The later publications of Bignami and Grassi [48, 47] show that they were quite intimate with it before they themselves attained any definite results.

Such being the case, in order to follow my work in Italy and elsewhere, all that was now needed was to determine the genera of my grey and dappled-winged mosquitoes from such indications as I had been able to give. The former had been described in two papers, and was most evidently closely allied to *Culex pipiens*, and the latter, in which the æstivo-autumnal parasites had been shown to develop, were described in 1897 [38] as follows :—

"The latter are a large brown species biting well in the day-time, and incidentally found to be capable of harbouring the filaria sanguinis hominis. The back of the thorax and abdomen is a light fawn colour; the lower surface of the same, and the terminal segments of the body a dark chocolate-brown. The wings are light brown to white, and have four dark spots on the anterior nervure. The haustellum and tarsi are brindled dark and light brown. The eggs—at least when not properly developed—are shaped curiously like ancient boats with raised stern and prow, and have lines radiating from the concave border like banks of oars—so far as I have seen, a unique shape for mosquito's eggs. The species appears to belong to a family distinct from the ordinary brindled and grey insects, but there is an allied species here, only more slender, whiter and much less voracious." In the next paper [39] these small insects also are called "dappled-winged."

At that time in Italy the culicidæ had been carefully studied by Ficalbi in several works [31], and it was an easy task for anyone possessing these works, and also having fresh mosquitoes for dissection, to determine the genus of my dappled-winged mosquitoes from my description alone. Although I did not give the entomological criterion of the genus *Anopheles* (the long palpi of the female), I gave three other details which sufficed for the identification. First, the dappled-winged mosquitoes belonged to a group distinct from the grey mosquitoes (*Culex pipiens* type). Secondly, both species of this group had spotted wings, and still more particularly, one of them (certainly) had exactly "four dark spots on the anterior nervure." Now it is well-known that very few *Culices* and *Stegomyiæ* have spotted wings, while *Anopheles* almost always have them. The *Anopheles*, however, not only generally possess spotted wings, but the spots are *generally four in number and arranged along or close to the anterior nervure.* Lastly, if any doubt remained the observer would only have to catch the first spotted-winged female gnat and to examine the eggs within her, when they would be immediately seen to possess the characteristic *boat-like shape*, with the well-known clasping membrane simulating *oars on either side.*

It is curious that some of those who have written on the subject have overlooked the fact that the very first Italian mosquito, which from its name alone would be suggested by my description, was *Anopheles claviger*. Two of the synonyms of this insect are *Anopheles quadrimaculatus*, Say, and *Anopheles maculipennis*, Meigen.

There is, however, no doubt whatever that the Italians detected

the genus of my dappled-winged mosquitoes, because they themselves say so in two of their articles of November [48] and [51]. Nuttall admits the fact [74]. But there is reason to suppose that they recognised the insects long before November.

It was evidently Manson's paper of June 18th, 1898, which stimulated the Italians to renewed activity, because they set to work shortly afterwards. But their success was delayed by efforts towards originality. Grassi endeavoured to find the guilty species of mosquito by its prevalence in malarious localities. His efforts were a close repetition of mine in the Sigur Ghat—even his servant was attacked by malaria as mine had been. He discovered three species of guilty mosquito, namely, *Culex penicillaris, C. malariæ* (so named by him, really *C. vexans*), and *Anopheles claviger*—principally (*per lo meno*) the first [44]. I have already shown in sections 11 and 12 how useless it is to attempt to identify the malaria-bearing species by its preponderance in malarious places; and it has now been demonstrated that even in Italy there is no such relation between the disease and its agent. *Anopheles* abound where there is no malaria—even round Liverpool. Needless to say, then, two out of the three species isolated by Grassi have nothing to do with the disease. He was right regarding the third, *A. claviger;* but it is quite reasonable to suppose that he detached this simply from my description of the dappled-winged mosquitoes. As a matter of fact all these epidemiological efforts of Grassi, though interesting in a small way, were nothing but a series of vague speculations.[1]

Meantime Bignami, after four years' inaction, had returned to his old method of attempting to infect men by the bites of mosquitoes brought from malarious places. His results are minutely recorded in his paper [48]. He set to work in August—that is, after Manson had proclaimed at the British Medical Association that I had succeeded in infecting birds by the bites of mosquitoes [43]. Bignami's task was now vastly simplified; with the guidance of my work he collected his mosquitoes from infected houses; whereas if he had continued to act in accordance with his own theory he would have collected them from marshes, which would

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[1] The writers of some zoological text books, who have evidently had little personal experience of the disease, seem to have actually believed that Grassi determined the *Anopheles malariferi* by these efforts. That is not the case. In an early work [54] I said that they were made independently of Manson and myself; but this was written before I studied the Italian work with close attention, and since then I have withdrawn the statement [72].

have led to constant failure (section 13). He claimed his first success early in November, but still could not say which of the various kinds of mosquitoes employed by him had produced the result.[1]

Up to November, therefore, the Italians had failed either to find the guilty species of mosquito or to demonstrate the life-cycle of the parasite in the insects. At this point Charles's series of eight letters addressed from Rome to me (dated from November 4th to January 14th) commence. They have been printed by me with his consent, and show clearly (what, however, can be also demonstrated from their own writings) that the Italians were then intimately acquainted with my work; that they had received my report [42] giving full details of *technique*, and that they had detected the genus of my grey mosquitoes (from specimens sent by Manson) and of my dappled-winged mosquitoes (from my description. In his letter of November 8th, 1898, Manson records having sent some of my preparations to Charles and Bignami (on or before that date); and Charles, in his letter of November 25th, records showing one of these to Grassi (on or before that date). It is possible, however, that the Italians had seen my preparations long before this, as numbers of them had been sent to Manson and Laveran in the spring and summer; and they may also have seen those of Koch, who had cultivated *Proteosoma* in Rome in September.

Bignami, Bastianelli, and Grassi had now evidently determined to resort to the correct method for determining the guilty species of mosquito, and imitated exactly the experiment by which I had ascertained the second host of *Proteosoma* in the previous March. The experiment was recorded by them on November 28th [51]. They fed six *Culex pipiens*, one *Anopheles nigripes* and four *Anopheles claviger*, on some cases of crescents, and at last found my pigmented cells in two of the last species. They do not record the exact date on which this observation was made, but from Charles's letters it would appear to have been on November 25th or later.

This, if correct, was the first definite demonstration of the guilty

[1] That human malaria is conveyed by the bites of mosquitoes had, of course, been proved—practically to a certainty—by my infection of numerous birds three months previously. Bignami's experiment was merely a formality, of which the success could already be foretold with confidence. The statement, frequently made, that he was the first to give experimental demonstration of this fact may be set aside without comment.

species of mosquito in Italy. It was made fifteen months after my original demonstration of the same parasite in the same genus of mosquitoes in Secunderabad on August 20th, 1897 [38], and nearly four months after Manson had announced the whole life-cycle of *Proteosoma* at the British Medical Association [43]. The Italian experiment was, however, of doubtful correctness, because the authors do not state that the mosquitoes used by them had been bred from the larvæ [51]. At the same time they actually impute to me the very fault which they themselves were committing, and do so contrary to the printed evidence of my own words.[1]

In their next paper [53] they claim to have found the various developmental stages of the æstivo-autumnal parasites in *A. claviger* caught in houses and stables, or fed on patients in hospital. Here again, examination of the publication shows that none of the insects employed seem to have been bred from the larvæ; and, what is still more important, the number of insects on which the observations were made is not exactly given. For all we know, the whole paper may have been written on the strength of only a very few positive results; and this is the more possible because it describes a life-cycle which is an exact repetition of that of *Proteosoma*. The authors give no precise differential experiments in order to prove the connection between the pigmented cells seen by them and the hæmatozoa. For this proof they rely upon my *Proteosoma* report [42], to which, however they scarcely refer. Although their paper gives to the ignorant the impression of being original, it is in reality merely a rescript of mine.

Meanwhile Bignami and Bastianelli had been continuing their attempts to infect men by *A. claviger* taken from houses, and claimed a second positive result early in December. In this case, however, by good fortune, the infection proved to be a mild tertian one. Some months later these two authors published a paper [56] recording the development of this parasite also in *Anopheles*. This was the first, and, indeed, only important Italian result which had not been previously indicated by me; I had made no observation connecting the tertian parasite also with the dappled-winged mosquitoes.

Subsequently the same authors and Grassi claimed to have

[1] They say that my experiment was doubtful because my mosquitoes may have previously bitten other animals [51, p. 314]. Now it is clearly stated in my publication [38, p. 1786] that the insects used by me had been bred in "bottles from the larvæ"; and from the whole tenor of my researches it was evident that such was the case.

demonstrated the development of the parasites in *Anopheles nigripes*, *A. bifurcatus*, and *A. superpictus*.

They also claimed to have shown that the members of the old genus *Culex* do not carry malaria; but this had long previously been abundantly proved by me in India, at least with regard to the æstivo-autumnal parasite; and the fact is that Grassi had only identified my grey mosquitoes, which I had shown to be negative, to this parasite. Their first drawings of the parasites in mosquitoes were not published until the spring.[1]

In my first reference to the Italian work I accepted it with some reserve; but after a careful examination of their writings made in 1900, I felt much more scepticism. Their work during the winter of 1898—99 is evidently hasty and deficient in exact details regarding the various observations; and the general tenor of their historical passages is so inaccurate as to inspire grave doubts regarding the whole literature. I think that at that time they found my pigmented cells in a few, possibly a very few, *A. claviger*, and that Bignami and Bastianelli also showed that the tertian parasite develops in the same insects; but beyond this it is impossible to speak with confidence. Many of their details also are derived from me.

My work was completed in the autumn of 1899 at Sierra Leone (section 22) and was published immediately [60]. Many of the details are incorporated in Grassi's book published in June next year [69]. This work, which is dedicated to Manson, is principally a compilation of the researches of others—the historical passages being quite inaccurate. At the bottom of page 31 of the first edition the author says: "Giova infine far risaltare che io arrivai agli *Anopheles malariferi* indipendentemente da Ross, le cui ricerche sui parassiti malarici degli uccelli furono pubblicate quasi contemporaneamente alla mia prima Nota preliminare." He and his colleagues found the *Anopheles malariferi* in Italy by detecting the genus of my dappled-winged mosquitoes; but they did not incriminate it with certainty until the end of November, five months after Manson published my work on the malaria of birds [41]. Grassi's "first preliminary note" [44] was published more than three months after this paper of Manson's, and, moreover, refers

[1] For an independent account of all these researches the detailed history of Nuttall [65] and especially his *critique* on the priority question [74], should be consulted.

See also [72, 73, 76].

to my work as a well-known matter even then. I found the *Anopheles malariferi* in two species of mosquito in India *fifteen months* before Bastianelli, Bignami, and Grassi found it in Italy. Speaking quite strictly and accurately it is the principal merit of Grassi to have discovered, not the *Anopheles malariferi*, but its correct entomological name.[1]

Excepting the discovery of the host of the tertian and perhaps the quartan parasites, the Italian work was simply a local affair, done, like the work of my colleagues and myself in Sierra Leone and of other observers in many parts of the world, on the basis of my Indian researches culminating in July, 1898 (section 17).

Of the sixteen and more species of *Anopheles* which have now been definitely connected with malaria, only three or four were incriminated by the Italians; it is therefore quite incorrect to attribute the determination of this relation to them—much more to attribute it, as some have done, to Grassi alone. The connection between *Anopheles* and malaria has been determined by the united efforts of many observers in many parts of the world.

(*c*) Certainly not less important than the Italian work has been that of the Malaria Commission of the Royal Society, consisting of Drs. Daniels, Stephens, and Christophers. After confirming my results in Calcutta as mentioned in section 20, Dr. Daniels proceeded to British Central Africa, where he met Drs. Christophers and Stephens, who had proceeded there after a month's stay in Italy in the autumn. These observers had great trouble at first in obtaining suitable cases for experiment, but finally succeeded in doing so. Daniels confirmed our results in Sierra Leone, and added many useful and interesting details. Stephens and Christophers afterwards followed us in Sierra Leone and elsewhere in West Africa, and then proceeded to India.

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[1] Early in 1903 this writer published a pamphlet purporting to be a translation of important papers on the subject (*Documenti riguardanti la storia della scoperta del modo di transmissione della malaria umana;* Milano). It contains no bibliography nor accurate history of the events; and omits most of the principal publications of my work. It purports to give in full my paper recording the original discovery of the pigmented cells [38]; but on examining this copy I find that the drawings of the cells given by Manson, and the remarks of Manson, Bland Sutton, and Thin (all of which, of course, absolutely establish the genuineness of the discovery) are omitted without the smallest explanation. The author then proceeds to claim the discovery for himself. This work also is dedicated to Manson—a fact which may lead many to believe in its accuracy; but Manson has publicly stated that it was dedicated to him without his permission (*Lancet* and *British Medical Journal*, March 28th, 1903).

The researches of all these gentlemen are given in the admirable reports to the Malaria Committee of the Royal Society [71]. These researches have had the effect of completely consolidating previous work on the subject. The authors have shown no less than eight species of *Anopheles* to be amenable to the malaria infection, and that *Culices* and *Stegomyiæ* are always refractory; they have demonstrated many of the habits of these insects in various parts of the world; and, besides, have given us much invaluable information regarding the pathology of the disease, especially of blackwater fever. Stephens and Christophers also found independently the great law of Koch regarding the prevalence of malaria amongst native children in the Tropics.

The perusal of the writings of these gentlemen and of many other observers will convince any one that it is impossible to do justice to them in the form of a brief review; it is scarcely even fair to attempt to describe such a laborious work in a few words, and I shall therefore now draw this lecture to a close with the remark, that I hope soon to deal with all these investigations in a manner which is due to them. But I should like to conclude with the names of a few of those who have more recently added valuable information to our store of knowledge regarding the mosquito theory of malaria—particularly Ziemann, Manson, T. Manson, the members of the numerous expeditions of the Liverpool School of Tropical Medicine (Drs. Fielding-Ould, Annett, Dutton, Elliott, Logan Taylor), Fernside, James, Low, Sambon, Van der Scheer, Van Berlekom, Celli, Nuttall, Shipley, Ruge, Howard, Theobald, Schaudinn, and Sir William MacGregor. I omit to refer to their works, and those of many others, only because it is impossible to do so properly within the limits of this work.

It would not be right, however, to conclude without referring to those most conspicuous examples of the success of anti-malaria measures for the improvement of public health—the cases of Havana and Ismailia. A campaign against yellow fever and malaria was commenced at Havana early in 1901; and Colonel and Assistant-Surgeon-General Gorgas, of the United States Army, who was in charge of the work, has recently reported as follows on the success of it, in a lecture delivered on May 22nd, at the New York Post-Graduate Clinical Society:—

"The results of these combined measures were very marked. Mosquitoes entirely disappeared from many parts of the city, and were decreased everywhere. On the first inspection made in January, 1901, 26,000 collections of fresh water were found in the

city, containing mosquito larvæ, this exclusive of the cesspools. In January, 1902, the consolidated inspection reports covering the same area showed less than 300; but the most striking evidence was its results on yellow fever. It must be borne in mind that yellow fever had been constantly in Havana since 1760, that it was not, as it had been in our North American cities, some years present and some years absent, but steadily every year and every month and every day, in all that time. The deaths from yellow fever had been, since 1889, about as follows: 1890, 303; 1891, 364; 1892, 352; 1893, 482; 1894, 388; 1895, 549; 1896, 1,355; 1897, 743; 1898, 127; 1899, 118; 1900, 301; 1901, the first year of our mosquito work, 5; and since September, 1901, not a single case.

"The work with regard to malaria is not quite so striking, and this necessarily follows from the nature of the disease. But I think the results, as shown by the sanitary reports, are very hopeful with regard to malaria, and indicate that in the course of time malaria can be also eradicated. In 1900, the year before mosquito work, the deaths from malaria were 344; in 1901, the first year of mosquito work, they had fallen to 151; in 1902, the second year of mosquito work, they had dropped to 90, and for the first four months of 1903, 16."

At the end of 1902 the Suez Canal Company asked me to go to Ismailia on the Suez Canal, in order to advise regarding the best measures to take against the malaria, which had long been prevalent in that town. I advised active operations against the mosquitoes, and this advice was followed with great energy and success. The following table of statistics, kindly supplied by Prince D'Arenberg, the President of the Company, speaks for itself.

Statistique du Paludisme à Ismailia.

(*From the Statistics of the Suez Canal Company.*)

Mois	1897	1898	1899	1900	1901	1902	1903	1904
Janvier	83	94	201	156	128	162	13	—
Février	103	83	165	139	83	105	20	—
Mars	129	126	129	266	99	101	16	—
Avril	135	127	109	175	100	64	14	—
Mai	173	77	126	169	82	133	9	—
Juin	180	43	126	114	68	154	15	—
Juiliet	188	81	104	145	74	120	23	—
Août	242	86	107	166	123	130	19	—
Septembre ..	336	128	128	258	244	176	25	—
Octobre	254	178	172	228	372	139	39	—
Novembre.. ..	178	271	209	244	352	[1]174	12	—
Décembre.. ..	88	251	208	182	265	73	4	—
	2,089	1,545	1,784	2,284	1,990	1,551	209	—

[1] Operations commenced.

Not only, however, from this place do we hear of reduction of sickness and mortality. Undoubtedly the whole West Coast of Africa is much improved, and good accounts continue to flow in from Lagos, the Gold Coast, British Central Africa, Hong Kong, and further India; and it is to be hoped that within a few years malaria will, as Sir William MacGregor says, have lost its terrors, at least for Europeans who are called upon to serve in the Tropics.

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DESCRIPTION OF PLATES.

(These Plates are copied from those given in my *Report on the Cultivation of Proteosoma, Labbé, in Grey Mosquitoes*, dated May 21st, 1898; but in the description I have substituted for the appellation *proteosoma-coccidia*, temporarily used by me for the *pigmented cells*, the word now generally employed, namely, *zygotes*.—R. Ross.)

Note.—All the figures and plates were drawn by me accurately, according to scale, from actual preparations, most of which were preserved in formalin. Plates II. to IX. are faithful representations of entire fields.

Plate I.—Drawings of Zygotes from the second to the twelfth day.

Figs. 1—5, zygotes of the second day. Fig. 6, stained.

Figs. 7—11, zygotes of the third day. Fig. 12, stained.

Figs. 13, 14, 15, zygotes of the fourth day. Fig. 16, stained.

Fig. 17, zygote of the fifth day.

Figs. 18—22, zygotes of the sixth day and later.

Fig. 23, drawing in outline of the stomach of a mosquito studded with zygotes of the sixth day, seen by a low power.

Plates II. to VIII.—Fields of Leitz oel. imm., 170 minim. ($\frac{1}{12}$ inch).

Plate II., external coat of stomach studded with young zygotes of about thirty hours. Air vessel, crossing muscular fibres, and some oil globules are seen.

Plate III., external coat of stomach studded with young zygotes of about forty hours.

Plate IV., zygotes of third day. Vacuolated forms.

Plate V., zygotes of third day. Hyaline forms.

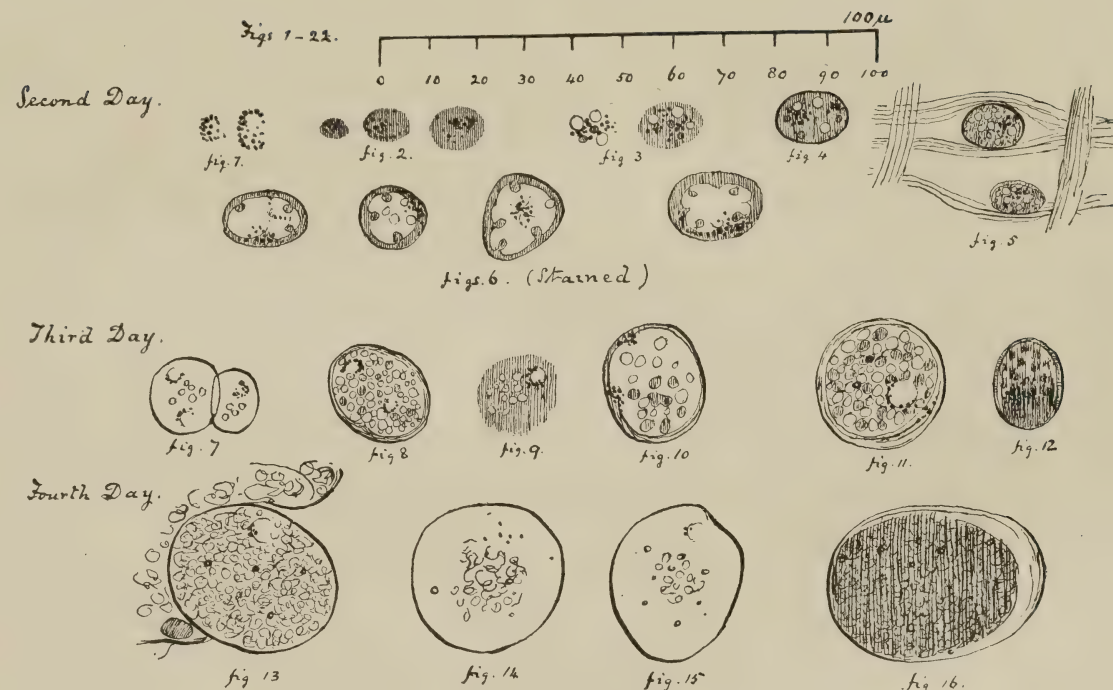
Plate VI., zygotes of fourth day. One vacuolated and three hyaline forms. One zygote of a second generation derived from a second feeding.

Plate VII., zygotes of the fifth day.

Plate VIII., zygotes of the sixth to seventh day. One zygote of a younger generation.

Plate IX., pyloric end of stomach studded with zygotes of the seventh day, seen by a power of medium strength.

Plate I.


Figs 1-22.
100μ
0 10 20 30 40 50 60 70 80 90 100
Second Day.
fig. 1.
fig. 2.
fig 3
fig 4
fig. 5
figs. 6. (Stained)
Third Day.
fig. 7
fig 8
fig. 9.
fig. 10
fig. 11.
fig. 12
Fourth Day.
fig 13
fig. 14
fig. 15
fig 16.

Continuation of Plate I.

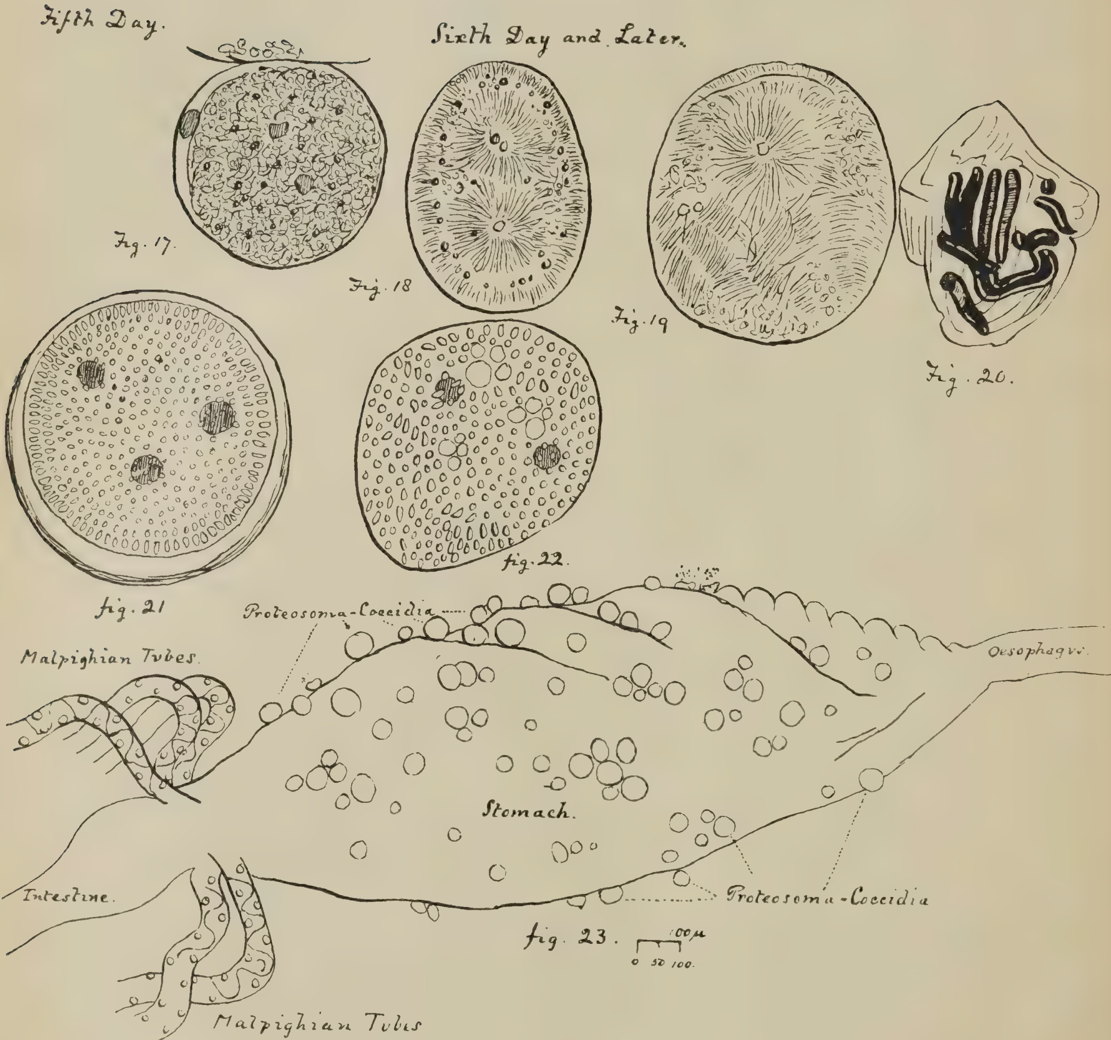


Plate II.

Plate III.

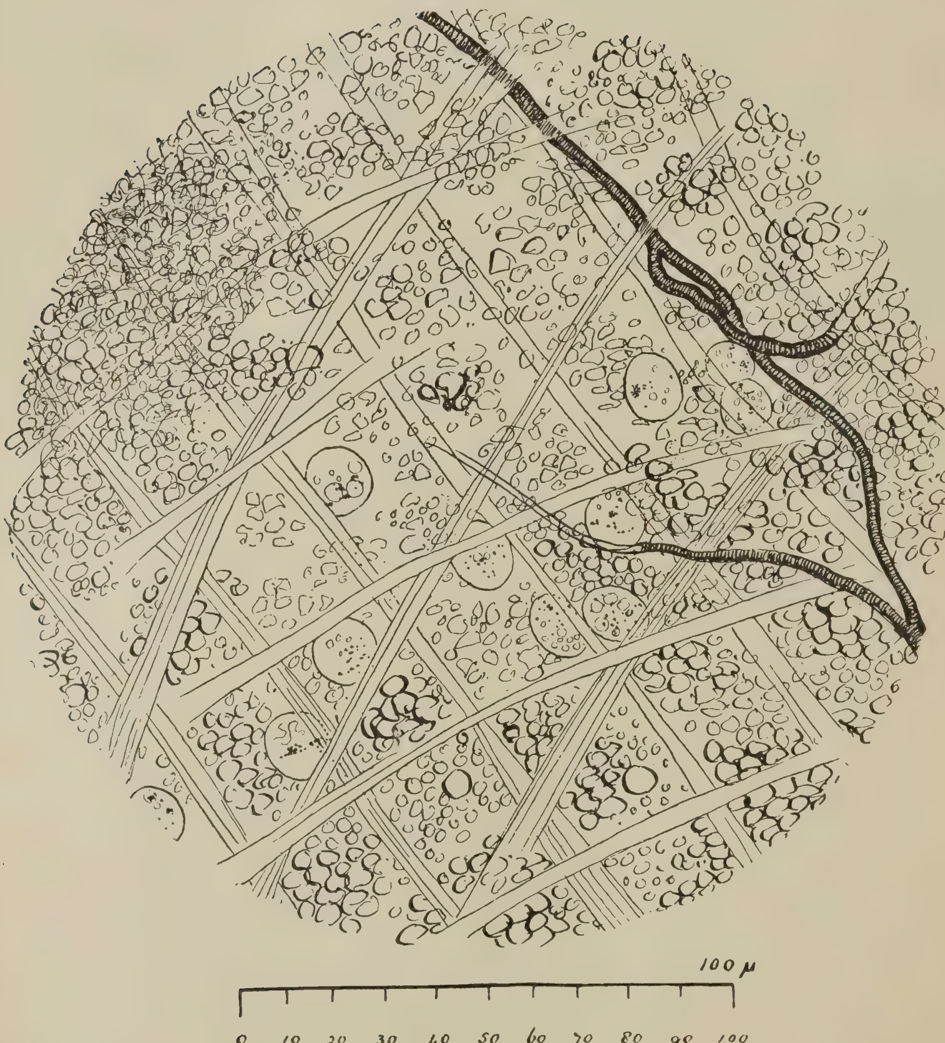


Plate IV.

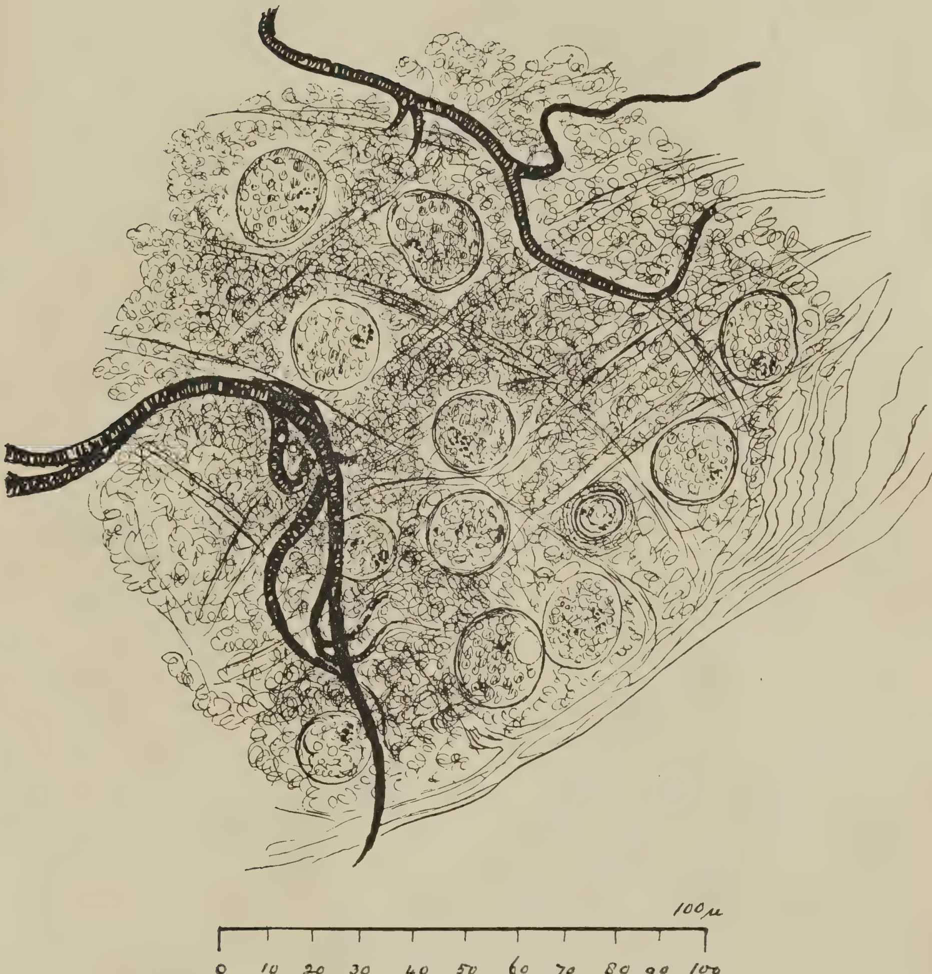


Plate V.

Plate VI.

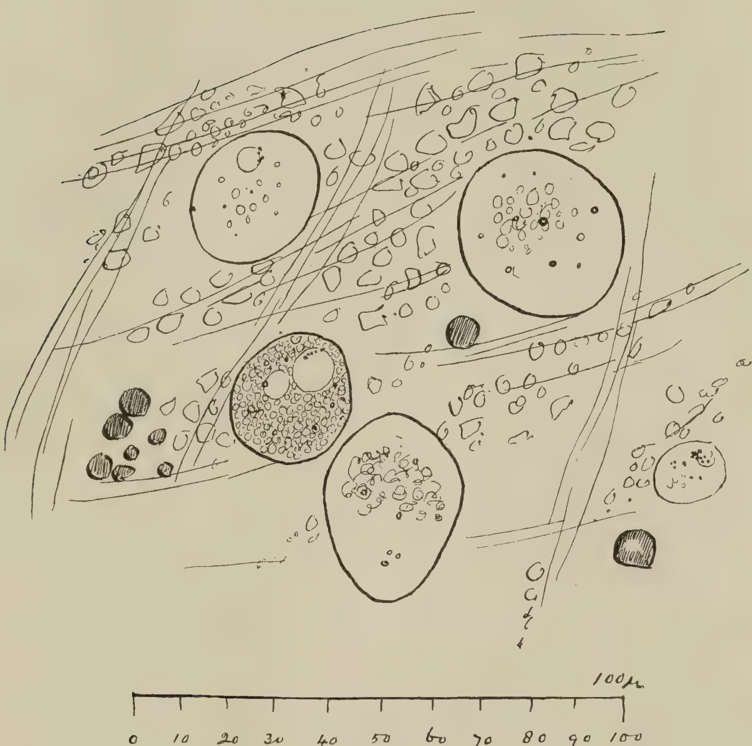


Plate VII

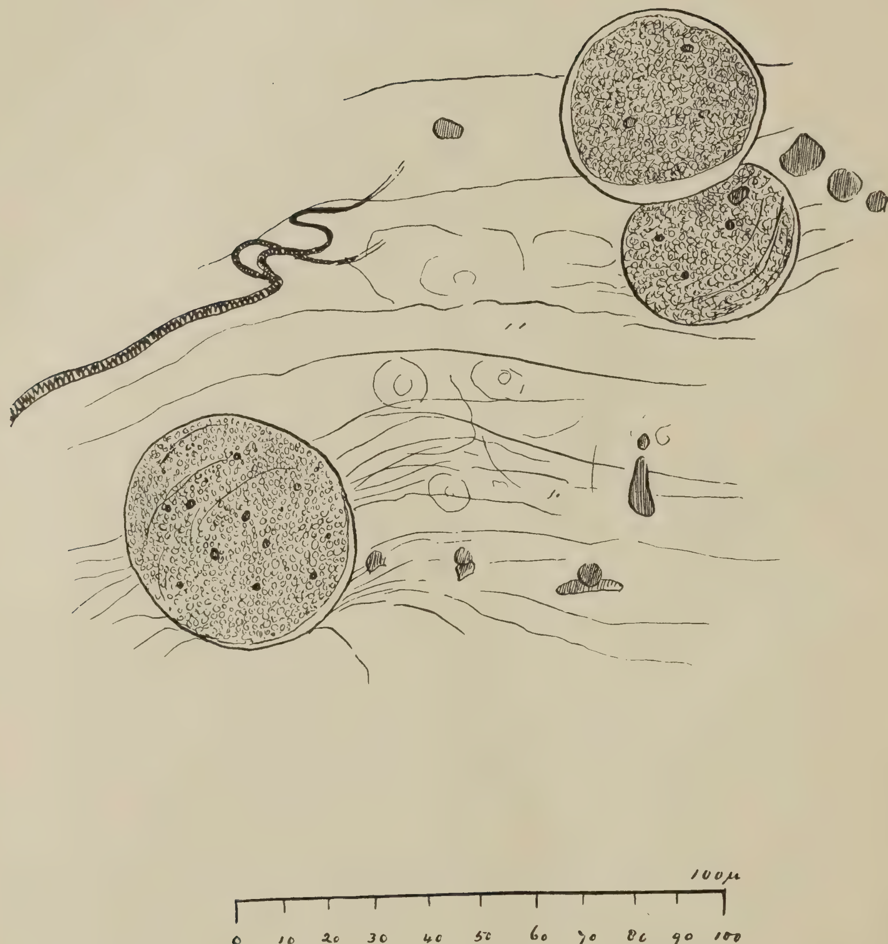


Plate VIII.

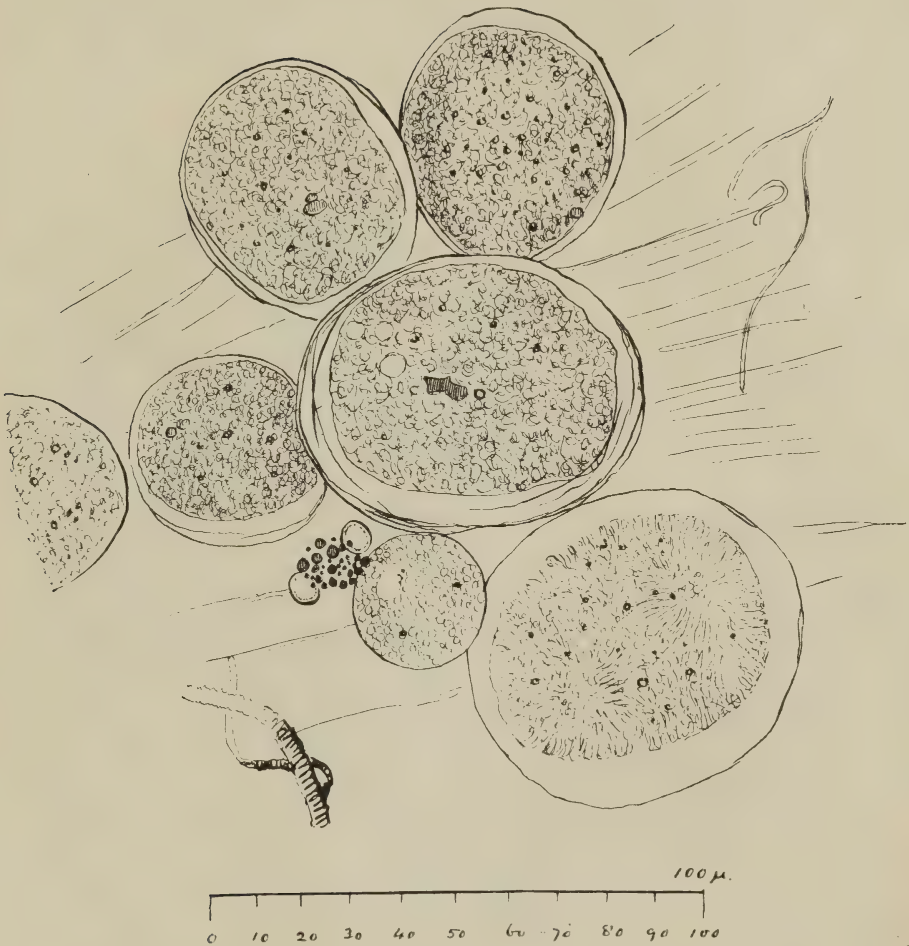


Plate IX.

ON THE FURTHER HISTORY OF FIVE CASES OF ARTERIO-VENOUS ANEURYSM OF THE NECK, WITH SOME REMARKS ON THE CONDITION GENERALLY, AND ITS TREATMENT.

By G. H. MAKINS, C.B., F.R.C.S.,
Surgeon to St. Thomas's Hospital, &c.

The cases upon which this communication are founded have already been published in my book on the "Surgery of the South African Campaign," but during the period of five years which has elapsed since they were first under treatment changes have occurred in their condition which seem to render their history worthy of continuation.

In again bringing them forward I take the opportunity of raising some questions with regard to arterio-venous communications in general.

(1) Carotid Arterio-venous Aneurysm.

The bullet (Mauser) entered at the right side of the pomum adami, and crossing the larynx and the course of the left carotid vessels, emerged at the anterior border of the left trapezius two inches below the angle of the mandible. Immediate hæmorrhage occurred from the exit wound, but ceased spontaneously. At the end of some four hours, during which the patient had been removed to a field hospital, the bleeding recurred, and an incision was made by the surgeon-in-charge with the intention of ligaturing the carotid artery. During the preliminary stage of the operation, however, the bleeding ceased, and the vessel was not exposed nor ligatured.

The patient was kept quiet for three weeks and then sent to the Base Hospital at Wynberg. At that time the external wounds were soundly healed, but there was considerable blood extravasation in the left posterior triangle of the neck, while swelling, pulsation and thrill were palpable beneath the sterno-mastoid, in the course of the bullet track, over an area $1\frac{1}{2}$ inches in breadth. A widely distributed machinery murmur was audible on auscultation, and this was troublesome to the patient himself when he lay with the left side of the head on the pillow. The left eye appeared somewhat prominent, but the pupil reacted normally to light, and was equal in size with the right. Laryngoscopic examination showed the vocal cords to be intact, but there was swelling of the upper part of the larynx,

the voice was weak and husky, and there was some cough. The patient complained of giddiness at times, but not of headache. The pulse numbered 100 per minute, it was regular, but irritable in character.

During the next four weeks the patient was kept at rest in the supine position and general improvement followed. Meanwhile the swelling became localised into a definite oval tumour in the line of the wound track, 2 inches long by $1\frac{1}{2}$ inches wide. After the first fortnight of rest no further diminution of size occurred in the aneurysm, and it was determined to apply a proximal ligature. This procedure at once arrested all pulsation in the sac, and materially reduced the strength of the purring thrill, but the latter was not extinguished. At the end of a week the wound was dressed and the stitches removed, when it was found that all pulsation in the aneurysm had ceased, although the thrill remained as before.

Shortly afterwards the patient returned to England with the aneurysm apparently consolidated, but when I saw him some six months later pulsation had recurred and a small oval sac was palpable beneath the sterno-mastoid. The thrill was slight compared with the condition prior to the operation and gave rise to little or no trouble. Pulsation was strong in the external carotid, but there was little in the common carotid artery. The patient's general condition was good, but the pulse remained from 110 to 120 in pace.

I assumed that the aneurysm was either at the bifurcation of the carotid, or at the immediate commencement of the internal carotid, and proposed to ligate the external carotid, as I thought that this would sufficiently diminish the blood supply to ensure the consolidation of the aneurysm without endangering the internal jugular vein or further upsetting the cerebral circulation. The patient, however, decided that he would rather await events, as the condition gave rise to little or no inconvenience, and I was quite inclined to fall in with this view, provided he did not return to active service.

During the next six months I saw the patient several times; he was leading an easy life at home, avoiding all strenuous exertion, and the condition steadily improved, the pulsation becoming less, and the thrill slighter.

At the end of five months (eleven months from the date of ligature of the common carotid) the aneurysm had apparently undergone complete consolidation, its place being occupied by a narrow oval tumour about 1 inch in length. All pulsation had ceased, and

thrill was hardly perceptible. A low, continuous hum was still present on auscultation, but the most striking feature was the presence of a sharp musical systolic murmur, similar to those present with an arterial cicatrix and contraction of the lumen of the vessel. During the next nine months these signs disappeared completely, and since then the patient has been continuously on active service.

On March 10th, 1904, the patient wrote as follows about himself: "I am able to give a most satisfactory account of myself. My neck gives me no trouble, my voice is strong again, and I can give words of command just as I did before the wound. I went through the last manœuvres at home in September without inconvenience, and we had a most trying time."

Captain Mitchell, R.A.M.C., was kind enough to send me the following report in June, 1904: "I consider the case one of perfect recovery; no signs can now be discovered in the neck to show that a varicose aneurysm has ever existed. The heart and pulse are normal. The only trouble ever experienced is shortness of breath on severe or prolonged exertion, but this is only of temporary duration." (The patient is 46 years of age.)

(2) Carotid Arterio-venous Aneurysm.

The bullet (Mauser) entered at the dimple of the chin, immediately below the mandibular symphysis, crossed the carotids just above the normal point of bifurcation, and emerged at the anterior border of the right trapezius. The patient was lying on his back with the head down at the moment he was struck. Some immediate hæmorrhage from the exit wound occurred, and later, while being transported to the field hospital, renewed hæmorrhage was so severe as to almost prove fatal. On the tenth day a considerable secondary hæmorrhage occurred.

The patient then came under the care of Mr. Cheatle, at Modder River. A large diffuse pulsating swelling, with loud machinery murmur and thrill, had developed. During the next three weeks this steadily contracted in size, the patient being kept at rest, and one month after the reception of the wound the patient was considered fit to undertake the journey to Wynberg.

On arrival at the Base Hospital a large aneurysm filled the carotid triangle. It extended from the mid-line of the neck backwards to the anterior margin of the trapezius, and vertically from the upper margin of the thyroid cartilage to the mandible. A fairly firm wall had formed, pulsation was both obvious and palpable,

and a well-marked purring thrill with loud machinery murmur was present. The latter worried the patient much when he lay with the right side of his head on the pillow.

The pulse numbered 100 and was somewhat irritable in character, the voice was weak and husky, and there was some difficulty in swallowing solids. The pupils were equal. The outline of the aneurysmal swelling was somewhat remarkable, extending on one hand in the line of the external carotid artery, on the other in the line of the wound track backwards to the edge of the trapezius.

During the succeeding fortnight the patient was kept at rest with the head between sand bags, and some further contraction in the size of the aneurysm was noted. A sudden increase then took place, the larnyx became pressed ¾ inch over to the left of the mid-line, while considerable extension downwards along the course of the common carotid raised a doubt as to whether it would be possible to expose that vessel on the proximal side without encroaching on the blood sac. It was determined, however, to make the attempt, and as it proved, the vessel was tied without difficulty at the upper border of the omo-hyoid. Pulsation and thrill disappeared completely on tightening the ligature. There was no dilatation of the jugular vein.

Four days later the aneurysm was found to be solid, and appreciably diminished in size. Neither pulsation nor thrill could be detected, but on auscultation a loud blowing murmur was audible, most marked at the posterior limits of the tumour. On the morning of the fifth day the patient stated that he had again noticed the "whirr" during the night; and on the eleventh, slight purring thrill again became evident in the upper part of the swelling. Pulsation was palpable in the line of the external carotid, but the aneurysm itself was solid and much contracted in size.

Ten months later no trace of the sac remained, but purring thrill was palpable and a machinery murmur audible. The pulse was still 100, the voice was strong and clear, and the patient was doing duty at the depôt of his regiment. Since that time the patient has been continuously on duty, the thrill has decreased much, and he describes his own condition four years after the injury as follows: "I cannot lace my boots unless my foot is raised, or my head becomes giddy. My right arm is weak, although stronger than it was; if I lift any weight it seems to go all down my shoulder. On cold, damp days, or with sudden changes in the weather, I feel a dull pain where the aneurysm used to be,

under my right ear. I have to sleep on my back. My nerves are improved, I can hunt on a good-mouthed horse; in fact, I am very much better."

Note received April 18th, 1905: "I am better in every way. I had a good fall out hunting, but was all right after it. I can sleep on my right side, but cannot put my head down much." This patient is on active service.

(3) Carotid Arterio-venous Aneurysm.

The bullet (Mauser) entered at the posterior border of the left sterno-mastoid, 1 inch above the clavicle, crossed the neck and emerged at the posterior border of the right sterno-mastoid, 2 inches above the sterno-clavicular joint.

The wound was attended by free hæmorrhage from the aperture of entry, "some quarts," and the patient's clothes were saturated. The voice became hoarse and weak, and there was inability to swallow anything for the first twenty-four hours. A swelling of a diffuse character was first noted at the end of seven days, this pulsated and a strong thrill was noted. Gradual contraction and localisation followed, and at the end of eight weeks the patient was allowed by Mr. Cheatle, under whose care he had been, to travel to Wynberg. At that time the aneurysm was smooth and rounded in character, about 1½ inches in diameter, occupying the whole width of the sterno-mastoid, and extending just beneath the clavicle. Well-marked expansile pulsation and purring thrill were present, and on auscultation a widely-spread machinery murmur. The voice was still weak and husky, but there was no dysphagia. The left pupil was larger than the right.

The patient acquired enteric fever, and when convalescent was sent home to Netley, as the aneurysm caused little discomfort. On arrival in England the patient was sent home to Canada, as he did not wish for any operative treatment.

The after history of this aneurysm is of much interest. After his return to Canada the patient contracted scarlet fever; but was later allowed to return to South Africa on active service, no interference with the aneurysm being deemed advisable. During 1904, while on duty, he was running a railway hand-car, which was thrown off the track, and the patient suffered a severe fall. During the first twelve hours he appeared to have received a severe shaking only, but some five or six hours later he was seized with severe pain and dyspnœa, and twenty-four hours after the accident he

expired. The medical man who attended him said the aneurysmal sac had burst.

This is the only instance in my experience in which a late rupture has been observed.

(4) Aneurysmal Varix of Innominate.

The bullet (Mauser) entered at the posterior margin of the left sterno-mastoid just above the clavicle, crossed the thorax, and emerged in the right anterior axillary line 1 inch below the anterior axillary fold.

Slight hæmoptysis, probably due to a wound of the lung, followed, and persisted for four days. At the end of that time there was some fulness over a circular area $2\frac{1}{2}$ inches in diameter, of which the right sterno-clavicular joint was a little to the inner side of the centre. Over this area faint pulsation was palpable, and a strongly marked thrill. A loud systolic bruit was audible over the same limit. There was neither pain or dyspnœa, the radial pulses were equal. The right pupil was larger than the left, and the eye was partially closed, but could be widely opened by the levator palpebræ superioris.

Little change occurred during the next six weeks, except that some gravitation ecchymosis appeared at the lower costal margin, pointing to mediastinal hæmorrhage, and a typical machinery murmur developed, while the initial prominence noted disappeared.

One year later the patient was at work as a lamp-trimmer, and beyond shortness of breath on exertion, complained little. The right pupil was still dilated, but the palpebral fissures were now symmetrical. The root of the right sterno-mastoid and the sternal third of the clavicle appeared prominent, and some pulsation was palpable beneath the muscle; but no definite evidence of a sac existed. The purring thrill was less obvious, and the machinery murmur less widely distributed.

Major Geddes, of the Royal Army Medical Corps, has kindly furnished me with the following report of the man's condition in February, 1904, four years and four months subsequently to the initial injury. The man is still earning his living as a lamp-trimmer. He suffers with some dyspnœa about seven or eight o'clock each evening. The pupils react equally, but the man states that his vision is dim, and that he is unable to read. The supra-clavicular fossa is deeper on the right than on the left side of the neck, and pulsation is visible in the right hollow only.

No tumour is to be discovered, no thrill is palpable, and the

"machinery murmur" which is present is only audible to the patient when he lies with the right cheek on the pillow at night. The radial pulses are equal, the rate of pulsation varying from 100 to 140.

Report on Condition on April 18th, 1905. *By Dr. A. Young.*

The man is regularly employed as an arc lamp trimmer, works about five hours a day, and on every day in the week. Since his return to Glasgow from South Africa he has kept very well, and for the past three years has been off work on account of illness on only two occasions—three days about a month ago, and four days two years since; the ailment each time being merely "cold."

He feels well enough and quite up to this work. The shortness of breath which he had for a time after coming home has been quite absent for at least six months. He can climb the 18 to 20 feet ladder, which he uses in the course of his work, without any breathlessness, and he has no trouble in climbing the two flights of stairs to his own home. His appetite is evidently not all it might be, and he says he sleeps badly, though considering the constant alteration in his working hours this is perhaps not unnatural. Very occasionally he suffers from frontal headache of a mild type—it is bilateral and not evidently related to any special cause. He has no cough, or hoarseness, or difficulty in speech or swallowing. About once a day, from no obvious exciting cause, and occurring at quite irregular intervals, a pain shoots suddenly from about the middle of the right supra-clavicular fossa, along the inner half of the clavicle, to the region of the right sterno-clavicular joint. It is of only moderate intensity and quite transient.

The right pupil is still somewhat larger than the left, but it seems to react quite well, both to light and for accommodation. Ocular movements seem normal. The palpebral fissures on the two sides are alike and normal. For some temporary dimness of vision he was a patient at the Glasgow Ophthalmic Institute about a year ago for several months. From the condition which then led to his going to that institute he states he has now fully recovered, and he has no eye trouble now.

His heart dulness is little altered from the normal, perhaps a little enlarged to the left. The heart sounds at the apex are almost pure, but a slight suggestion of systolic bruit can be heard. At the base it is more distinctly heard, but by no means well until the stethoscope is carried either out along the right clavicle for about 3 inches, or else upwards upon the right sterno-mastoid muscle

for about $1\frac{1}{2}$ inches. The systolic bruit is not heard high up in the neck, nor is it more than faintly heard upon the left side. It is not audible over the axillary or brachial arteries on either side.

There is *practically* no machinery murmur (indeed, I believe I would be justified in saying *absolutely*) either heard by the patient or to be heard by the examiner.

There is slight visible pulsation in the right supra-clavicular fossa, but none in the left or in the supra-sternal notch. The pulsation seen here is on palpation found to have a distinct *expansile* character. The right anterior jugular vein is not visible, but the external jugular is somewhat prominent. It is quite patent and evidently playing a much more important part than the left. There is no thrill. The prominence of the lower part of the right sterno-mastoid muscle still exists, but is not great; nor is there great prominence of the sternal end of the clavicle.

The pulse at rest (sitting posture) numbers 80, in the upright position 96, after a brisk walk from one end of the room to the other and back again, 104 per minute. Respirations are quiet and regular—about 16 per minute.

The man has quite a notable degree of lateral spinal curvature, the convexity being towards the right in the upper dorsal region.

A limited area, including the sternal one-third of the right clavicle and the region above, and for $1\frac{1}{2}$ inches below it, is relatively dull to percussion, but it is not strikingly so—only when contrasted with the left side.

There is evidence, it seems to me, of some aneurysmal enlargement about the junction of innominate with right sub-clavian, but it can hardly be of much size, and is certainly not progressing. The earlier venous communication must be, I should think, completely cut off now, and is evidenced by nothing beyond some disproportionate distension of one of the right superficial cervical veins, viz., the external jugular.

(5) Carotid Arterio-venous Aneurysm.

The bullet (Mauser) entered at the centre of the right infra-spinous fossa, and crossing the chest emerged between the heads of the right sterno-mastoid muscle.

There was no serious immediate hæmorrhage, but the injury was followed by some hæmoptysis and dysphagia, lasting for two days. The right radial pulse was noted to be diminished, and there was evidence of contusion of the ulnar nerve.

Twenty-four days after the injury a pulsating swelling had

developed, extending $1\frac{1}{2}$ inches upwards beneath the sterno-mastoid, and 2 inches downwards over the first intercostal space. Laterally it extended from the mid-line of the neck backwards to the centre of the posterior triangle. There was some evidence of a bounding wall, but the swelling was soft and yielding. A widespread thrill and machinery murmur were present. The right pupil was larger than the left.

The patient was sent home to England at the end of two months.

A year later the walls of the aneurysm had become dense and firm, it extended upwards $2\frac{1}{2}$ inches in the line of the carotid artery, just projecting beyond the posterior margin of the sterno-mastoid. The larynx was displaced $\frac{1}{2}$ inch to the left of the median line.

The thrill and murmur were less marked than before, the patient had not been at work, but had lived an ordinary life with his friends; he complained much of shortness of breath on exertion.

Major Geddes, of the Royal Army Medical Corps, has kindly furnished me with the following report in February, 1904, four years and three months subsequently to the initial injury.

The patient now earns his livelihood as a carman. The aneurysm has not increased in size, and its walls are firm and hard; there is practically no change in its condition. The pulse numbers 86.

There are fibrillar twitchings of the right deltoid muscle, which is wasting, as are also the remaining scapular muscles; the muscles of the ulnar border of the forearm are wasted, and the grip of the right hand has little power. Thus pressure on the posterior cord of the brachial plexus seems to have developed, and the man himself states that about six months before the neck had appeared more swollen for a time. These points seem to show that the aneurysm is not altogether stationary.

Report on Condition, by Dr. Archibald Young, as at March 31*st*, 1905.

"The man is still living at home and seems to enjoy good health, apart from the disability connected with his injury. He has been able for some months to take charge of a carrier's van, which delivers small parcels over the city. This occupies him on three or four days in the week, from 9 to 11 in the forenoon and from 3 to 5 in the afternoon. He is careful never to lift anything heavy, in fact he guards himself most carefully against all exertion. If he does at any time exert himself unduly, he becomes short of

breath at once, and is troubled with palpitation. At the same time (or under the same influence) the beating on the right side of his neck becomes unpleasantly emphasised. He resides at present in a third-flat house, and the climbing of the three flights of stairs, unless taken in most leisurely fashion, not only excites palpitation and makes him very short of breath, but is apt to induce an intense nausea. This is only occasionally followed by actual vomiting.

"The *heart dulness* is undoubtedly enlarged transversely, its left margin not much exceeding the normal, but the right reaching fully ½ inch to the right of the sternum. There is *no punctate apex beat* to be seen, but in the fifth and sixth interspaces and in the epigastrium there is general pulsation.

"The *heart sounds* over the apex are almost pure, though even there can be heard, somewhat obscuring the normal heart sounds, the *systolic aneurysmal bruit.* This becomes more and more apparent as the stethoscope is carried nearer to the base and over the sternum in the direction of the aneurysmal swelling. It is heard at its maximum intensity over the clavicle at its inner end, and is conveyed well up the neck and as far as the brachial at the bend of the elbow.

"*I entirely fail to observe any* '*purring thrill,*' *nor is there any evidence of* '*machinery murmur.*' With reference to this it should be stated that no such murmur is now audible to the man himself when lying on his right side. What he does hear is simply an exaggeration of the normal carotid pulse. Of this he is very clear.

"The *radial pulses* are not appreciably different in strength or rhythm, and at rest beat about 76 per minute.

"The *sensory and motor distribution of the ulnar nerve is still distinctly impaired*, but there is practically no sign of trophic disturbance.

"The man himself thinks his hand (right) somewhat stronger than it was, but it is still pretty weak as compared with the left.

"The *aneurysmal swelling is still very obvious.* Its anterior, upper and posterior limits are well defined, but its lower edge seems to pass behind the clavicle. The sterno-mastoid muscle passing over the sac gives it a bi-lobed appearance. Its *greatest transverse measurement is* 3½ *inches*, its upper limit reaches the level of the upper edge of the thyroid cartilage. The inner edge reaches almost to the middle line, the larynx being displaced to the left to the extent of ¾ inch. The aneurysm has a firm resistant wall.

"The *expansile pulsation* is not only palpable but plainly visible, even when the man is entirely at rest. There is no thrill of the 'purring' type.

"The same *loud systolic murmur* already referred to as transmitted to other parts, is heard over the aneurysm. There is *no enlargement of superficial veins.* The pupils are equal and react normally. The voice is still husky, but seems quite strong.

"There is little or no episternal pulsation.

"*Examined in the state of rest there is, in my opinion, now no clear evidence of venous disturbance. The symptoms and signs—the whole clinical picture—may quite well be explained with reference to a purely arterial lesion.*"

The cases above detailed illustrate two features, viz., the general tendency towards spontaneous cure exhibited by aneurysms resulting from wounds of healthy vessels, and also the effect of proximal ligature on such aneurysms. The grounds upon which proximal ligature was chosen in the first two cases in preference to a local operation were shortly as follows:—

In the first I believed the internal carotid artery and the internal jugular vein to have been in communication, and considered that it would be much more prudent in the first instance to avoid the risk of cerebral trouble, which must be allowed to be considerable when these vessels are tied simultaneously. My opinion was, that in any case the varicose aneurysm would be converted into a varix, and that this, if necessary, could be treated with less risk when the sac had been obliterated. The final result not only justified this opinion, but in addition demonstrated that an aneurysmal varix may get well spontaneously, when the force of the arterial circulation has been lowered by a proximal ligature.

In the second case the indication for active interference was more pressing, since a secondary extension of the aneurysm was taking place. Here the same reasons which had influenced me in the first case to prefer a proximal ligature were again taken into account, but in addition to them there was reason to regard a local operation as a procedure of extreme risk, since the sac was very extensive, and it appeared probable that both external and internal carotids might be implicated. In any case a proximal ligature of the common carotid would have been needed as a preliminary precautionary measure. In this case also the course adopted seems to have thoroughly justified itself.

The two cases first seriously raised in my mind the question as to whether we are justified in laying down a definite rule that such injuries are without exception treated as cases of wounded artery, and I shall attempt to show that good reasons exist for deviating from this rule in certain instances.

It may be useful first to recall the possible nature of the injury to the wall of the vessels which may be inflicted by a bullet of small calibre. Experience has shown this to be most variable in regard to extent. In some instances both artery and vein may be completely divided. In such injuries, which are not very uncommon, the development of an arterio-venous aneurysm is unlikely, and no question can exist as to the necessity of ligaturing the four open ends of the vessels at the earliest possible moment. With regard to the latter point, however, it is interesting to note, that clinically the accident is not always easy of prompt discrimination, since cessation of pulsation in the distal vessels does not always follow (Lougheed).[1] It is the lesser degrees of injury which are most likely to be followed by the form of aneurysm under consideration. These consist either in clean perforations, or in the removal of more or less elliptical portions of the vessel wall.

With regard to the ultimate result of such injuries, there is abundant evidence to show that: (1) Such wounds of the wall may cicatrise efficiently without the formation of an aneurysm; (2) that when four openings in the two vessels are made the two corresponding to the adjacent sides of the artery and vein only may remain patent, while the openings of primary entry and final exit may cicatrise without the formation of an aneurysm; (3) that an elliptical wound of an artery may cicatrise not only without the formation of an aneurysm, but even without the occurrence of any gross primary hæmorrhage into the tissues adjacent.[2] The probability of sound cicatrisation is also supported by the large number of wounds accurately crossing the lines of vessels in which neither primary or secondary hæmorrhage is observed, while still further evidence is afforded by signs of partial arterial obstruction often seen under these circumstances, such as local vascular murmurs, and marked diminution in force and volume in the distal portion of the vessels.[3]

The occurrence of partial and incomplete healing of the same nature is also suggested by bursts of secondary hæmorrhage sometimes observed in wounds, the closure of which is delayed by sepsis or some other cause, and again by the late discovery of many

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[1] "Surgical Experiences in South Africa," p. 125.

[2] See a case reported by Johnston, "Stevenson's Wounds in War," Second Edition, p. 449; and similar observations were made by other surgeons, Sir W. MacCormac, &c.

[3] "Surgical Experiences in South Africa," p. 113; *l.c.*, p 112.

aneurysms, a frequent experience, generally too readily referred to want of observation on the part of the surgeon under whose care the patient initially came. Cicatrisation of the vessel wall may be aided by the adhesion of a neighbouring structure; thus in a case of nerve injury, reported by Major Freyer, "the musculo-spiral nerve was found glued to the axillary artery by a small tarry-looking blood clot, the disturbance of which gave rise to profuse hæmorrhage from an opening in the vessel. There was no extravasation of blood into the tissues, and no indication before operation (which was undertaken on the eleventh day after the injury), that the artery was wounded."[1]

In a somewhat similar case of Sir W. Stokes, the wound of the artery was practically plugged by the intrusion of the musculo-spiral nerve. In a case mentioned on p. 13, the sartorius served the same purpose. The temporary plugging or compression of a vessel by a bullet is a much less common event with those of small calibre than with those of larger size, but a somewhat remarkable substitute is found in instances in which small bullets have not only perforated vessels, but have run along their lumen for a considerable distance and obstructed their channel.[2]

Non-perforating wounds, involving some part of the thickness of the arterial wall only, come for all practical purposes into the same category as the injuries already dealt with. In either class of case it is difficult to estimate the frequency with which secondary yielding of the scar takes place, but in all probability the chances of this accident are somewhat greater than our present experience allows us to determine. As to the special conditions which lead to the development of an arterio-venous aneurysm in cases of gunshot wound of the vessels, beyond the fact of perforation of both artery and vein, we are, for the most part, only in a position to theorise. One or two points, however, appear open to no doubt. First, it is clear that the force of the heart's action in any given case must be of ætiological importance, and in this connection it is obvious that the quieter the patient can be kept after the infliction of the wound, the greater will be his chances of escaping further trouble. Secondly, the absence of any primary hæmorrhage into the tissues, observed in many cases where the vessel cicatrises, is an important factor, since the collection of blood in continuity with the vascular wound at once furnishes a potential cavity liable

[1] Journal of the Royal Army Medical Corps, vol. ii., June, 1904, p. 682.

[2] *Le Caducée*, No. 2, 1901, p. 21, M. Schloffer, Flobert.

to become later the aneurysmal sac. The occasional development of a simple varix seems to prove that the lumen of the vein as the vessel in which the blood-pressure is the lower, may offer and encourage an opportunity for a diversion of the stream and the maintenance of the communication. A case of Major Freyer's, already alluded to, furnishes an example. "Both artery and vein were found to have clean holes punched in them, the anterior wound in the artery was occluded by a firm clot which was firmly attached to the sartorius muscle over it ; the artery and vein communicated by corresponding apertures, and the hole in the posterior wall of the vein was healed. No extravasation of blood had taken place, although the vessels (femoral at the apex of Scarpa's triangle) were of such large size."[1]

Given the formation of an arterio-venous aneurysm, the arrangement may present many variations equally difficult to explain or foretell. In another place[2] I have adverted to the anatomical arrangement of certain vessels as calculated to favour the development of either aneurysmal varices or arterio-venous aneurysms respectively. In the case of the latter the most varied conditions may be met with in the relative part taken by either vessel in the formation of the swelling attributed to the aneurysm. Thus we may find :—

(1) That the apparent aneurysmal swelling depends either upon a great dilatation of the proximal portion of the artery, or of the distal portion of the vein.

(2) The aneurysmal sac may be in connection with the artery alone, the communication between the artery and the vein being merely a small patent aperture.

(3) The sac may lie between the two vessels and separate the artery and vein more or less widely.

(4) Both vessels may have a large lateral communication with a large sac.

(5) The arterio-venous communication may take place through an opening in an intervening structure, as in the subclavian varix, operated upon by Matas,[3] in which the communication traversed the anterior scalene muscle.

The position of the sac is probably determined by two factors, one, the liability to spread in the direction of least resistance, and

[1] "Stevenson's Wounds in War," Second Edition, p. 449.

[2] "Surgical Experiences in South Africa," p. 131.

[3] *Trans. Amer. Surg. Assoc.*, 1901, vol. xix., p. 237.

secondly, and more important, the tendency of the sac to occupy the space produced by any collection of blood formed at the time of the initial injury. As has been pointed out elsewhere this space is, as a rule, more constantly to be found in the exit than in the entry portion of the wound track.

Some interesting work on the experimental production of aneurysmal varices has lately been carried out by Vignolo and by Franz.[1]

Vignolo excised elliptical portions of the walls of the common carotid artery and internal jugular vein, also of the femoral artery and vein in dogs. The vessels were then accurately anastomosed by suture. Some of the animals died from hæmorrhage, in others a typical aneurysmal varix was produced and the following changes were observed.

The vein dilated rapidly with the development of pulsation and thrill, while considerable dilatation of the distal veins of the head in cases of union of the carotid and jugular, or œdema of the lower limb when the femoral vessels were anastomosed.

The artery suffered by atrophy of the muscular coat, while the vein became thickened by inflammatory hyperplasia and dilated.

Certain effects were also observed in the general circulation; thus when the femorals were anastomosed an increase in the systolic wave, with a corresponding decrease of the diastolic wave, of the pulse. In the case of the cervical vessels this alteration was not observed, but merely a sinking of the blood-pressure; a difference in result explained by Vignolo on the ground of the absence of valves in the cervical veins and consequent want of obstruction in the distal circulation.

Another interesting observation was the uniform tendency of the condition to undergo spontaneous cure, as the result of thrombosis occurring in the distal segment of the vein.

These experiments support the conclusion that the main factor in the development of an aneurysmal varix rather than an arterio-venous aneurysm, lies in a sufficiently close approximation of the walls of the adjacent vessels and the absence of a primary collection of blood at the seat of injury. They also illustrate a similar tendency to spontaneous improvement, or cure, observed in arterio-venous communications in man.

That this tendency to spontaneous cure may be supplemented by the lowering of the local blood-pressure by the application of a

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[1] *Centralblatt für Chirurgie*, 1902, p. 1060. *Ibid.*, 1904, p. 22.

proximal ligature, has been shown by the cases above detailed as well as by others under various surgeons.[1]

Treatment.—No general rule can be laid down for the treatment of arterio-venous aneurysm, but in each case the method must be made to suit the location of the aneurysm and the special conditions which may exist. Of the latter the most important are the individual characters of the aneurysm, the condition of the neighbouring soft parts and the date at which the aneurysm comes under observation. Each may have a distinct bearing on the choice of procedure.

The methods from which we have to choose may be summarised as follows:—

Local incision or extirpation of the aneurysm, the vessels being ligatured immediately beyond the confines of the sac.

The application of a proximal ligature to the artery alone in as near contiguity to the aneurysm as possible (Anel's operation); not at the "seat of election," unless this corresponds with the latter indication.

The preliminary application of a proximal ligature, followed at a later date by incision of the sac and clearance of its contents.

Suture of the openings in the vessel wall. It may be said at once of this method, that it is at present in its infancy and is suited to vessels of large size only.

It may be well to at once eliminate cases in which primary hæmorrhage is still continuing, since here there can be no true aneurysm, and no doubt can exist as to the propriety of ligature at the point of injury.

When primary hæmorrhage has ceased, however early the case may come under observation, two points arise for consideration: (1) Will an arterio-venous aneurysm develop? To which question, in the light of present experience, we can only give an uncertain answer. (2) Can we assume that the tendency to spontaneous cicatrisation of the wounded vessels will be increased by the application of a proximal ligature? There is no doubt evidence in favour of this possibility, but it is mainly derived from the result of operations for simple arterial hæmatomata, and in view of the almost constant sequence of localisation and consolidation of the primary swelling up to a certain point, it is in most cases better to temporarily maintain an expectant attitude.

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[1] Ker, "Surgical Experiences in South Africa," p. 153; Cecil Birt, *Brit. Med. Journ.*, vol. ii., 1902, p. 641; Freyer, Journal of the Royal Army Medical Corps, vol. ii., No. 5, p. 558; Treves, *Brit. Med. Journ.*, vol. i., 1902, p. 1135.

The degree of consolidation of the wall of the aneurysm of course depends in the main on the age of the tumour. As a general rule a firm and well-defined wall is in favour of the probability of obtaining complete consolidation if the force and amount of the blood supply be lessened by proximal ligature, but in cases of old standing the probability of further cicatrisation and contraction of the opening of communication between the artery and vein is naturally less, since the latter has probably reached its permanent condition and size.

Extensive extravasation of blood into the surrounding soft parts in recent cases is a condition of great moment, since it gives rise to pressure upon the vessels on the enlargement of which increase of the collateral circulation depends. In the neighbourhood of the knee this is especially marked and it is well to bear in mind that this contraindication to a distant proximal ligature may persist for some time.

A good example of this is furnished by the following case, for the notes of which I am indebted to Dr. Archibald Young.

A wound crossing the popliteal space was followed by the development of an arterio-venous aneurysm. This filled the space transversely, its upper and lower limits being somewhat indefinite. Signs of pressure existed in considerable neuralgic pain in the distribution of both the popliteal nerves, but there was no enlargement of the superficial veins and the pulse in the posterior tibial artery was good. The femoral artery was ligatured low down in Hunter's canal, twenty-four days after the injury. No attempt at the development of any collateral circulation followed. On the third day evidence of commencing gangrene was noted, and later the limb was amputated.

The popliteal space was found to be filled by a large cicatricial mass, the superficial part of which encircled and filled up the space between the internal and external popliteal nerves, as high as their origin at the bifurcation of the sciatic, and as low as the space between the two bellies of the gastrocnemius. The artery and vein were closely attached together and immediately above the point of formation of the vein its anterior and posterior walls exhibited a perforation ·5 centimetre in diameter. Similar openings were found in the wall of the artery, and in the tissue which firmly bound the vessels together a small cavity extended 1·5 centimetres in a downward direction. A probe passed into the arterial opening found its way into a large irregular blood sac situated between the femoral condyles and surrounded by very dense connective tissue.

The sac, entered by a probe passed through the anterior wall of the artery, seemed to extend from the level of the upper margin of the condyles to the lower angle of the popliteal space (about 5 centimetres), and transversely corresponded to the space between the condyles (about 1·5 centimetres). A dense plexus of veins surrounded the sac, the lymphatics were dilated and a number of glands were enlarged.

The catgut ligature which had been applied to the femoral artery was still *in situ*, the vessel contained clot on the proximal side, the distal portion was collapsed; in the sac itself was recent clot.

"*All the articular vessels were dissected with much difficulty from the dense cicatricial tissue surrounding them, and their incorporation in this must have interfered with any attempt towards the establishment of a collateral circulation by their aid.*"

The mode of communication of the vessels concerned in the aneurysm is no doubt a matter of importance in regard to the probability of cure by the application of a proximal ligature. It is difficult to draw any conclusions on this subject, except to say that the entry of an additional small vessel into the sac itself is a very unfortunate condition in so far as the cure of the varix is concerned. Such vessels are most commonly in connection with the venous element. A good example of the condition is figured in a case of extirpation by Guinard.[1]

In this case a thin-walled sac the size of a turkey's egg, containing a small amount of clot, communicated laterally with the femoral artery by a short channel the size of a pencil. The artery and vein were closely applied, the communicating opening being of the size of a lentil; the opening on the distal wall of the vein had cicatrised firmly, and just below a tributary vein entered. Such vessels are no doubt the cause of failure occurring after the application of ligatures immediately above and below the communication in pure varices.

The situation of the aneurysm is, however, the most important point in the determination of the method of treatment.

Neck.—A special difficulty met with in this situation, perhaps only equalled in the instance of the deep and superficial femoral vessels, is the exact localisation of the point of communication. Thus in the cases detailed above, of those at the root of the neck, in one (No. 3) some doubt for a time existed whether the inferior thyroid or the common carotid was the vessel implicated (temporary

[1] *Bull. et Mem. de la Soc. de Chirurg. de Paris*, tome xxviii., p. 1125.

swelling of the thyroid gland, irregularity of the pupils, and paresis of the muscles supplied by the recurrent laryngeal nerve raising the question). In No. 2 doubt existed as to whether one or both of the carotids was wounded, in Nos. 4 and 5 the localisation to either innominate, carotid, or subclavian, had to be considered, and in No. 5 time alone allowed the carotid to be definitely fixed upon as the wounded trunk.

Again, in considering a local operation, we have to consider the risk to the cerebral circulation of simultaneous ligature of both carotid artery and jugular vein.

Lastly, the extreme severity of the operation itself, as judged by the accounts of recorded cases, seems to render the local incision of the aneurysm inadvisable, except under circumstances of extreme urgency. Cases published by Dr. Clark[1] and by Matas[2] support this opinion.

My own view, therefore, is in favour of allowing time for the consolidation and contraction of the sac, and then the application of a proximal ligature, when practicable, in all cases involving the great vessels of the neck.

Upper Extremity.—My personal experience and published cases show that a proximal ligature may with safety and a good chance of success be applied to the vessels above the elbow, and for wounds at the elbow itself this procedure is to be generally preferred. In the mid-arm a local operation is simple, and in the forearm the same may be said. In either of the latter situations a local is to be preferred to a proximal operation, as more nearly approaching the ideal and necessitating no obvious risks.

Trunk.—The iliacs are the vessels particularly likely to demand treatment. In the case of these vessels some difficulty may arise in localising the aneurysm to the external or internal branch again; the sacs in the retroperitoneal tissue are liable to be extensive and irregular. For these reasons the transperitoneal type of operation is to be preferred. A proximal ligature will probably suffice, and in the case of the internal iliac is obviously to be preferred.

Lower Extremity.—It is here that most judgment is needed, both in regard to operative difficulties, and to the somewhat unsatisfactory results that have been observed to follow the application of a proximal ligature.

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[1] "My Experiences in South Africa," H. E. Clark.

[2] Matas, *Trans. Amer. Surg. Assoc.*, 1901, vol. xix., p. 237.

Difficulty in exact localisation of the wound may exist in two situations, first in the region of the superficial femoral and the profunda and its branches; secondly in the calf, where doubt may arise as to whether the posterior tibial or peroneal vessels are concerned when the track is transverse, or whether the anterior or posterior vessels are implicated in antero-posterior tracks. Embarrassment to the operator has occurred under all these circumstances, and necessitated the alteration of procedure to meet existing difficulties. Again, attention may be called to the technical difficulty in dealing with the aneurysm locally when the wound in the anterior tibial artery lies close to the point at which the vessels pierce the interosseous membrane.

As to the occurrence of gangrene of the limb after proximal ligature of the vessels, this in my experience is particularly to be apprehended when the seat of election has been chosen independently of the exact seat of the aneurysm, and when the lesion is of the popliteal vessels. A case has been already recounted illustrating the probable explanation of the failure of development of the collateral circulation and its causes. To this may be added an instance in which a proximal ligature applied some months after the development of the aneurysm was followed by an immediate good result, but in which the patient lost his leg as the result of gangrene supervening on a trivial injury a few weeks later. In a third case I saw the application of a proximal ligature to the popliteal vessels for an aneurysm of the calf followed by the development of well-marked muscular ischæmia and its attendant troubles.

In speaking of the treatment of arterio-venous aneurysms generally, while theoretically no doubt can exist as to the ideal nature of a strictly local operation dealing immediately with the vascular wounds themselves, experience has shown that in many instances the procedure is difficult, dangerous both to life and the integrity of neighbouring structures, and in some instances impossible. Local operations involving interference with the aneurysmal sac should therefore be confined to such situations as allow them to be readily and safely performed and to the smaller vessels generally. Such operations may also be indicated when slighter methods have failed to ameliorate the conditions existing.

Ligature of the artery at the seat of election is to be avoided, as not only unpromising, but as also, especially in the lower extremity, dangerous.

A ligature placed as near as possible above the aneurysmal

sac has been shown to be safe, to afford a reasonable prospect of cure, and not to prejudice a further operation, should this become necessary in the case of failure. Where convenient it may be reinforced by a second ligature placed on the distal side of the sac, or in certain situations by the ligation of an important proximal anastomotic vessel (*e.g.*, anastomotica magna, in low operations on the femoral) (Freyer).

In conclusion, I must express my indebtedness to Dr. Archibald Young, Major Freyer, C.M.G., Major Geddes, Dr. Colin Sewell and Captain Mitchell, who have aided me with information, or in following up the history of the cases recorded.

REPORT ON THE PREVALENCE OF ENTERIC FEVER IN BERMUDA, WITH TABLES AND DIAGRAMS.

By Major J. W. COCKERILL.
Royal Army Medical Corps.

Part I.

Section I.—Physical and Sanitary Characteristics.
- (*a*) Geography and Geology.
- (*b*) Climate.
- (*c*) Sanitation.
- (*d*) Water Supply.
- (*e*) Food Supply.

Section II.—General Prevalence and Mortality.
- (*a*) Annual Prevalence.
- (*b*) Annual Variations.
- (*c*) Case Mortality.
- (*d*) Relative Prevalence and Mortality.

Section III.—Seasonal Prevalence.

Section IV.—The Influence of Age and Service.
- (*a*) The Influence of Age.
- (*b*) The Influence of Service.

Conclusion.

Enteric fever is endemic in Bermuda, and is the only disease which can be called prevalent. Assistant Surgeon W. G. Don, M.D., Royal Engineers, wrote a report, which was published in the Army Medical Department Reports for 1869, Appendix VI., since which time a mass of statistics have become available, but no collection of them can be traced. As such a collection is only valuable when compared to others, it was considered advisable to follow upon the lines of the very exhaustive report on enteric fever, in Pietermaritzburg, by Major R. J. S. Simpson, published as Appendix XI. to the Army Medical Department Reports for 1898. A comparison will show how greatly this report is indebted to Lieutenant-Colonel Simpson's work. Unfortunately the statistics of simple continued fever are not nearly so full as those of enteric fever, but as far as possible, they have been included.

Section I.—Physical and Sanitary Characteristics.

A.—Geography and Geology.

Bermuda is a group of islands lying close together and practically connected throughout by bridges (*see* attached map).

The geological formation is usually described as coralline limestone, but as a matter of fact the islands, as well as the adjacent reefs, are of Æolian sand drift. The foundations rest upon a submerged mountain rising abruptly from the ocean bed. Mountain limestone is found in two or three places. There is evidence that upheavals have occurred. Formerly the extent of the dry land was very much greater, but a general subsidence taking place the lower-lying hills on the leeward (northern) side sank below sea-level, forming the reefs. Gradually the summits which remained above water have been washed away, until now only the North Rock remains. This is about ten miles from the present shore-line. The reefs are covered with growing coral, which, however, only forms a thin coating over the lower Æolian rock. The higher hills on the windward side are the present islands. The extreme length of the group is about fifteen miles in a direct line; the average breadth is about one mile. The military stations are as follows :—

(*a*) On the high ground above the town of St. George the old capital.

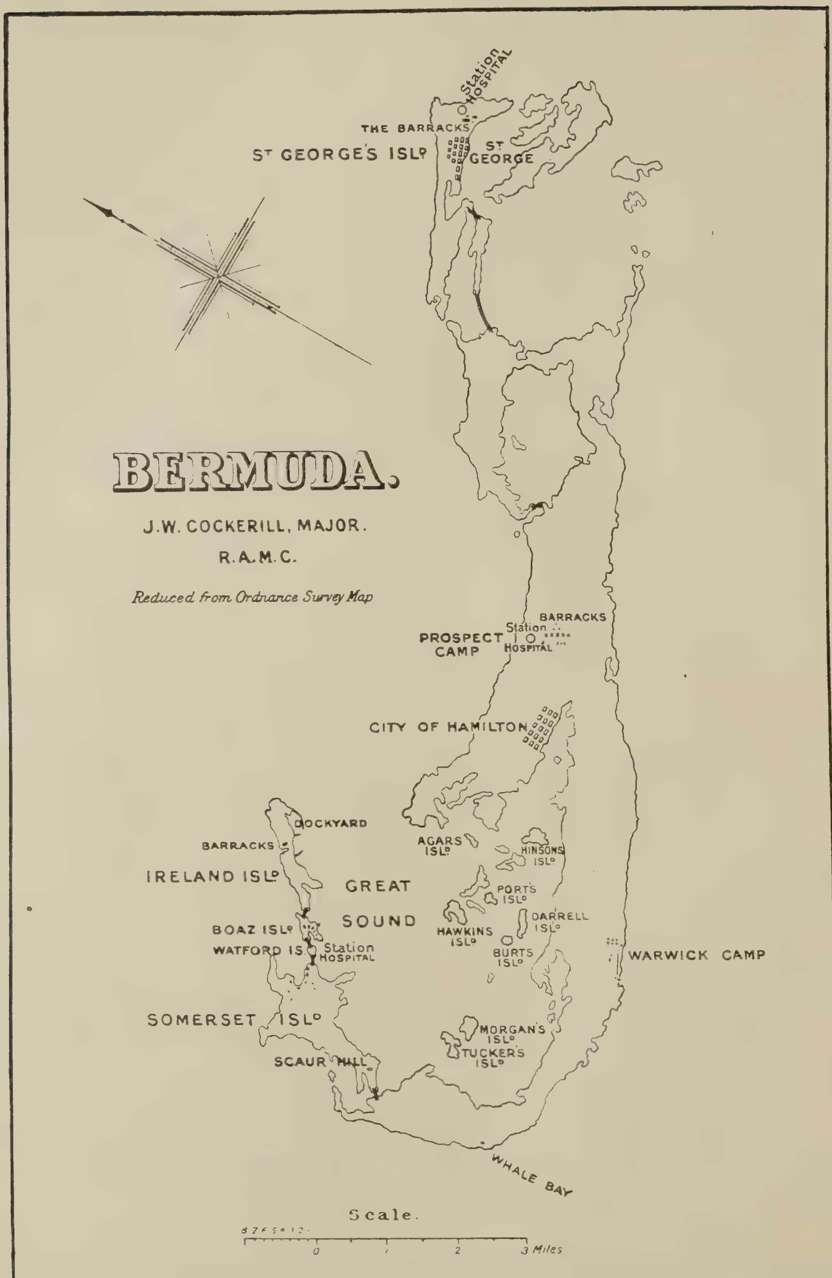
(*b*) Prospect Camp, on a plateau about a mile from Hamilton, the present capital.

(*c*) Warwick Camp, formerly only occupied for a few months every year, but now kept open continuously. Two or three companies are usually in camp at the same time. Each one remains for six weeks, or two months. They go there for their annual musketry course, usually leaving on its completion. Sometimes companies are kept there for longer periods owing to lack of accommodation elsewhere.

(*d*) Whale Bay. The Royal Garrison Artillery from St. George's come here for their annual gunnery course, living under canvas for a couple of weeks. A few men of the Royal Garrison Artillery live all the year round in Whale Bay Battery.

(*e*) Scaur Hill. The company of Royal Engineers at Boaz go into camp at Scaur Hill for three or four weeks yearly, for field training.

(*f*) Boaz Island and Watford Island are close together, and are situated between Somerset Island and Ireland Island. The barracks are on Boaz, and the Station Hospital on Watford.


Station HOSPITAL
THE BARRACKS
ST GEORGE'S ISLD
ST GEORGE
BERMUDA.
J.W. COCKERILL, MAJOR.
R.A.M.C.
Reduced from Ordnance Survey Map
BARRACKS
Station
PROSPECT CAMP
HOSPITAL
CITY OF HAMILTON
DOCKYARD
BARRACKS
IRELAND ISLD
GREAT SOUND
AGARS ISLD
HINSONS ISLD
PORTS ISLD
DARRELL ISLD
HAWKINS ISLD
BURTS ISLD
BOAZ ISLD
WATFORD IS
Station HOSPITAL
WARWICK CAMP
SOMERSET ISLD
MORGAN'S ISLD
TUCKER'S ISLD
SCAUR HILL
WHALE BAY
Scale.
0
1
2
3 Miles

(*g*) Ireland Island is almost entirely occupied by the dockyard and naval establishments. There is, however, a barrack occupied by detachments of the Royal Garrison Artillery and Army Ordnance Corps. There are Station Hospitals at Prospect, St. George's and Watford. The sick from Warwick Camp are treated at the former; and those from Whale Bay and Scaur Hill at the latter.

B.—Climate.

The climate of Bermuda is subtropical. The mean monthly temperature varies from about 62° to 82° F. There are no sudden variations. Frost and snow are unknown. The winter months are cool and pleasant. From June to October it is hot and enervating. The mean relative humidity is about 82 per cent., as an annual average, it varies from 74 per cent. to 87 per cent. There is no particular rainy season, rain falling more or less every month. The average annual rainfall for the past ten years is sixty-two inches. Tables and diagrams are attached, but will be considered when dealing with the seasonal prevalence of enteric fever and simple continued fever.

C.—Sanitation.

(*a*) Prospect has been very greatly improved during the last ten years. The water carriage system is now universal, with the exception of the old married quarters, infants' school and some officers' quarters.

Fresh water is used for flushing the drains; it is, however, a very curious defect, that there is not a proper system of pipes to connect the latrines, &c., with the storage tanks. As a consequence, water has frequently to be brought in carts from the reserve tanks. Instead of having a supply tank from which water would gravitate to baths, wash-houses and latrines, there are a large number of small independent tanks, each with its own pump. Further, these tanks, with the large reserve tanks, do not hold a third of the amount which is desirable, having a total capacity of less than fifty days' supply, whereas I calculate there should be one hundred and forty-five days' supply for all purposes. As a result the latrines can seldom be flushed properly.

The barracks are excellent, lofty and well situated. There are no separate dining-rooms, but the wide open verandahs are used for this purpose.

There are no sinks for washing up, as a consequence small scraps and foul water are thrown out on the ground in the proximity.

There are no urinals near the barracks, so tubs are used at night. Both these are weak points in the sanitary armour.

Food has hitherto been stored in cupboards in the barrack-rooms, attracting swarms of flies; wire gauze safes are now being provided, and are kept on the northern verandahs.

The kitchens are within a hundred yards of the latrines, and consequently within visiting distance of flies. The windows and doors are now to be fitted with wire gauze.

Excellent sanitary bins have lately been provided instead of open refuse pits.[1]

(*b*) Boaz is not so well situated as Prospect. The island is low lying and small. The barracks are old, dating from the time when the island was a convict establishment. They do not afford nearly sufficient accommodation for the present garrison.

The surplus was accommodated in tents in 1902, but during 1903 a number of huts were put up, and as they were taken into use a corresponding reduction in the number of men under canvas was made.

During the last two years a water carriage system has been completed, but it is most defective. The drains are open to the sea, and in some cases below high tide level for half their length. Consequently drains and man-holes are sewage logged for twelve out of every twenty-four hours. Naturally obstructions are constantly occurring. The exits of the drains (five in number) do not extend far enough from the shore, which is thus constantly contaminated.

(*c*) St. George's Barracks I know nothing about, except that sea water is pumped up for flushing purposes (as it is also at Boaz), the water carriage system being in force.[2]

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[1] In spite of the sanitary precautions mentioned, a serious outbreak of enteric fever occurred at Prospect last autumn. The latrines (which are of the trough pattern) were constantly in a very bad sanitary condition, owing to the impossibility of flushing them sufficiently often. The improvements required in the water supply were reported, and the work sanctioned in principle before the occurrence of the outbreak.

[2] I have since ascertained that at St. George's the water carriage system is only in force in the permanent barracks; owing to lack of accommodation two out of three companies of infantry have been encamped. For their use dry earth bucket latrines have been employed. The water used for flushing is very brackish well water. The drains empty into the sea below low water mark, and work well. The drinking water is collected from roofs and specially prepared areas, being then stored in tanks.

(*d*) Warwick Camp is still dependent upon the "dry earth system." As the earth is very seldom dry, and as steps are only now being taken to protect the latrines from the weather, the arrangements hitherto existing are open to very serious objection. It is not too much to say that Warwick Camp is, and always has been, a hot-bed of enteric fever. It is occupied by three or four hundred men all the year round, but officially it is regarded, and always has been regarded, as a purely temporary musketry camp. All the men live under canvas, and a proportion of the tents are pitched over concrete floors. A large hut has recently been erected and taken into use as a dining-room : a very great improvement.

(*e*) In Bermuda generally the hotels and the best class of private residences have water-closets leading by a drain into a trapped cesspit 20 or 30 feet deep. The porous sandstone soon absorbs the liquid sewage ; and when opened very little residue remains. They cause no unpleasantness, and apparently no injury to health. No American visitor has ever contracted the disease in an hotel, and enteric is rare among the better class white population. Formerly Hamilton was most unsanitary, but improvement has taken place.

Dr. Eldon Harvey, the present Medical Officer of Health, giving evidence before a Committee in 1889, stated : "It is usual to find the privy, ash-pit, and water-tank in close proximity, all in the same yard, where also slops are thrown out to be absorbed." This takes place still, but now the privies are emptied every six months, and the house rubbish is removed by the municipality. These privies are middens, usually with the floor 4 or 5 feet below the seat. Recently the public-houses have been fitted with water-closets, instead of these middens, an improvement which will certainly have a good effect upon the health of the troops. That soldiers frequently contract disease in civil resorts is indisputable ; the effect of stopping French soldiers visiting public-houses at Chateaudun is reported on p. 427 of the Army Medical Department Reports in Appendix No. V., by Lieutenant-Colonel Macpherson. A better proof of the importance of preventing soldiers from visiting insanitary places could not be wanted.

The town of St. George's is generally considered to be freer from enteric than the other parts of Bermuda. Much deeper and darker middens are in use there, many going down to a depth of 30 or 40 feet.

Generally speaking, the sanitary condition of the country away from the towns is worse than it is in St. George's and Hamilton.

This applies to the neighbourhood of Warwick Camp, and to a greater extent to Somerset Island. Here, when any sanitary arrangements exist at all, the shallow privy is found. They are seldom or never cleaned out; as a consequence most objectionable smells are prevalent, and middens are found which contain masses of filth, swarming with flies. It is not therefore to be wondered at that soldiers visiting such houses should become infected.

D.—Water Supply.

The universal system is the collection of rain water from the roofs of buildings, or specially prepared areas, into tanks, which are almost always underground, and frequently under the floors. The water is pumped out as required, but dipping is common in the smaller houses, and is considered to be advantageous, being a means of aeration. Tanks among the civilians are seldom cleaned out. The Hon. Mr. Gosling, in giving evidence before the Committee of 1889, stated, "the limit of ten years is often exceeded." It is generally believed that throwing out slops into the yard, and the presence of shallow middens in the vicinity cannot contaminate the water in a tank, since the rock is so porous that, if the cement lining be cracked, the tank soon runs dry. Dr. Wilkinson (a leading practitioner in Hamilton), in his evidence in 1889, says he takes exception to this, and adds, "where I have thought I have discovered the source of the disease, it has been in cases where the water got low in the tank, and was evidently bad, by the smell." It is obvious that such a tank must have been a danger long before the water became as foul as that.

The collecting areas are often near the roads, and thus liable to contamination from the dust of the streets, from which the droppings of animals are never removed. The roofs are whitewashed occasionally, but no separators are used. Hence, not only dust, but bird droppings, dead fledglings, fragments of birds' nests, and other impurities find their way into the tanks.

The water supply of the barracks is open to the same objections, but being farther from traffic than houses in the towns, not to the same extent. The military tanks are subject to regular inspections, and are cleaned out much more frequently.

The water collected at Boaz is insufficient in amount, the deficiency is supplied by bringing water from catchment areas on the islands in the Great Sound. These are only liable to contamination from bird droppings, since the departure of the Boer prisoners of

war. It is, however, open to pollution in transit, being pumped through canvas hoses, first into tanks on steamers, and thence into those on shore. There is a catch on the leeward side of Warwick Camp, close to the tents and road, and this is certainly liable to contamination by polluted dust.

Aerated Waters.—These are manufactured by various firms in Hamilton and elsewhere, from water collected as described, which is sometimes filtered through charcoal. The source of origin of the water and method of manufacture, are not always above suspicion. Arrangements are being made to manufacture aerated waters in barracks.

E.—Food Supplies.

The food supplies are the same as for the civil population, and are of good quality. Very little fresh milk is obtainable by soldiers, other than patients in hospital. The dairies from which the hospital supplies are drawn are kept in good sanitary order. No cases of disease have been traced to contaminated milk.

Vegetables are difficult to obtain, those issued being usually imported. The small local cultivator manures his field with the contents of his privy, but it is very doubtful if the vegetables grown ever find their way into barracks.

Flies.—Flies are very numerous, particularly from May to December, and rapidly collect over any refuse or exposed food. The steps that have been taken to prevent contamination from this source have been mentioned.

Section II.—General Prevalence and Mortality.

A.—Annual Prevalence.

Army.—During the twenty years 1884 to 1903, out of a total military strength of 29,390 N.C.O.'s and men there were 841 admissions for enteric fever, with 137 deaths, giving admission and death-rates per 1,000 of strength of $28{\cdot}6 \pm 3{\cdot}14$ and $4{\cdot}66 \pm 0{\cdot}55$ respectively. During the same period there were also 671 admissions for simple continued fever (including febricula) without any deaths, giving an admission rate per 1,000 of $22{\cdot}8 \pm 1{\cdot}72$; or a total admission rate for all continued fevers of $51{\cdot}4 \pm 5{\cdot}19$, the death-rate being that for enteric fever.[1]

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[1] I have used Jevons's formula for calculating the probable errors, the probable error being the error of mean square multiplied by 0·6745. The error of mean square is the quadratic mean of the apparent errors; that is, the result of dividing

TABLE A.—GENERAL PREVALENCE.

Year	Military Forces									Naval Forces									Cilvians			Army and Navy combined
	Average Annual Strength	Enteric Fever				S. C. Fever		Total		Average Annual Strength	Enteric Fever				S. C. Fever		Total		Estimated Population. Census Years in Italics	Enteric Fever		Ratio per 1,000
		No. of Cases	No. of Deaths	Ratio per 1,000 Admissions	Ratio per 1,000 Deaths	No. of Cases	Ratio per 1,000 Admissions	No. of Cases	Ratio per 1,000 Admissions		No. of Cases	No. of Deaths	Ratio per 1,000 Admissions	Ratio per 1,000 Deaths	No. of Cases	Ratio per 1,000 Admissions	No. of Cases	Ratio per 1,000 Admissions		No. of Deaths	Ratio per 1,000 Deaths	Deaths
1884 ..	1,551	62	10	40·0	6·45	48	30·9	110	70·9	880	4	1	4·5	1·14	5	5·6	9	10·1	15,000	11	0·73	4·52
1885 ..	1,385	29	10	20·9	7·22	28	20·2	57	41·1	1,087	2	1	1·9	0·92	6	5·9	8	7·8	15,000	7	0·47	4·54
1886 ..	1,227	28	4	22·8	3·26	25	20·4	53	43·2	1,419	3	1	2·1	0·70	12	8·4	15	10·5	15,000	7	0·47	1·89
1887 ..	1,183	50	8	42·2	6·76	51	43·1	101	85·3	1,055	4	Nil	3·8	Nil	1	0·9	5	4·7	15,000	6	0·40	3·57
1888 ..	1,346	128	18	95·1	13·37	45	33·4	173	128·5	1,311	Nil	Nil	Nil	Nil	4	3·5	4	3·5	15,000	3	0·20	6·77
1889 ..	1,320	27	6	20·5	4·54	16	12·1	43	32·6	1,515	2	Nil	1·3	Nil	16	10·6	18	11·9	15,000	9	0·63	2·12
1890 ..	1,546	62	10	40·1	6·47	69	44·6	131	84·7	1,375	4	2	2·9	1·45	7	5·1	11	8·0	15,000	8	0·56	4·11
1891 ..	1,610	27	5	16·9	3·12	21	13·1	48	30·0	1,475	1	Nil	0·7	Nil	3	2·1	4	2·8	*15,123*	7	0·49	1·62
1892 ..	1,363	22	6	16·1	4·40	15	11·0	37	27·1	1,550	3	1	1·9	0·64	21	13·5	24	15·4	15,500	6	0·39	2·37
1893 ..	1,390	43	9	30·9	6·47	26	18·7	79	49·6	1,600	13	1	8·1	0·62	24	15·0	37	23·1	15,500	1	0·06	3·34
1894 ..	1,410	22	5	15·6	3·54	16	10·4	38	26·0	1,400	3	Nil	2·1	Nil	13	9·3	16	11·4	16,000	4	0·25	1·74
1895 ..	1,447	107	20	73·9	13·82	69	47·7	176	121·6	1,300	2	Nil	1·5	Nil	2	1·5	4	3·0	16,000	9	0·55	7·28
1896 ..	1,387	27	4	19·5	2·88	21	15·1	48	34·6	1,669	4	1	2·4	0·60	4	2·4	8	4·8	16,500	5	0·30	1·63
1897 ..	1,521	34	7	22·4	4·60	19	12·5	53	34·9	1,657	4	Nil	2·4	Nil	8	4·7	12	7·1	17,000	5	0·29	2·20
1898 ..	1,730	26	4	15·0	2·31	19	11·0	45	26·0	1,470	8	1	5·4	0·68	Nil	Nil	8	5·4	17,000	3	0·17	1·56
1899 ..	1,700	20	Nil	11·8	Nil	42	24·7	62	36·5	1,869	4	Nil	2·1	Nil	7	3·7	11	5·8	18,000	8	0·46	Nil
1900 ..	632	7	Nil	11·1	Nil	11	17·4	18	28·5	1,856	9	1	4·9	0·54	1	0·5	10	5·4	18,000	8	0·44	0·40
1901 ..	1,014	11	1	10·8	0·99	13	12·8	24	23·6	2,002	6	Nil	3·0	Nil	2	2·0	8	5·0	*18,481*	5	0·27	0·33
1902 ..	2,051	63	9	30·7	4·38	57	27·8	120	58·5	2,030	43	3	21·13	1·48	5	2·5	48	26·63	19,000	4	0·21	2·94
1903 ..	2,577	46	1	17·8	0·39	60	23·7	106	41·5	1,803	30	Nil	16·6	Nil	7	3·8	37	20·4	19,500	4	0·20	0·23
Average or Total	29,390	841	137	28·6	4·66	671	22·8	1,512	51·4	26,490*	76*	10*	2·9*	0·38*	136*	5·1*	212*	8·0*	326,500	120	0·37	2·51
Probable Error	—	—	—	± 3·14	±0·55	—	± 1·72	—	± 5·19	30,323	149	13	± 0·29*	± 0·07*	148	± 0·68*	297	± 0·86*	- -	—	± 0·025	± 0·29

* The figures marked with an asterisk do not include the years 1902 and 1903.

Navy.—As is at once apparent from the rates for each year given in Table A, the incidence among the men of the Royal Navy and the Dockyard underwent a complete change in 1902. An explanation will be attempted later, in the following figures the years 1884 to 1901 only are taken. With a strength of 26,490 men, there were 76 admissions for enteric with 10 deaths, giving admission and death-rates of $2{\cdot}9 \pm 0{\cdot}29$ and $0{\cdot}38 \pm 0{\cdot}07$ respectively. During the same period there were 136 admissions for simple continued fever without any deaths, giving an admission rate per 1,000 of $5{\cdot}1 \pm 0{\cdot}68$; or a total admission rate for all continued fevers of $8{\cdot}0 \pm 0{\cdot}86$.

Civilian.—It is impossible to ascertain the number of cases which occurred among the civil population. For a few years past a system of notification has been in force, but it is not of any statistical value.

The Registrar-General's returns are available, however, in the case of the death-rate. During the twenty years 1884 to 1903, the civil population has amounted approximately to 326,500, among whom 120 deaths have been returned as due to enteric or typhoid fever. This gives a ratio per 1,000 of $0{\cdot}37 \pm 0{\cdot}025$. The annual variations are small, and can be seen by referring to Table A.

In this calculation all deaths among the military and naval forces, as well as among their wives and children, have been ignored.

Owing to the absence in Bermuda of any diseases likely to terminate fatally which could readily be mistaken for enteric, I think these figures are very close to the actual death-rate. One or two deaths returned as "hæmorrhage of the bowels" are open to suspicion, but their number is insignificant. A number of cases are returned as "diarrhœa," and perhaps some of these were really due to enteric, but of this there can be no proof.

B.—Annual Variations.

If now the annual variations be considered, it will be seen from Diagram No. 1 that the columns representing cases diagnosed enteric fever and simple continued fever respectively vary proportionately. There are two exceptions in 1888 and 1895, where the enteric fever column far overtops that for simple continued fever.

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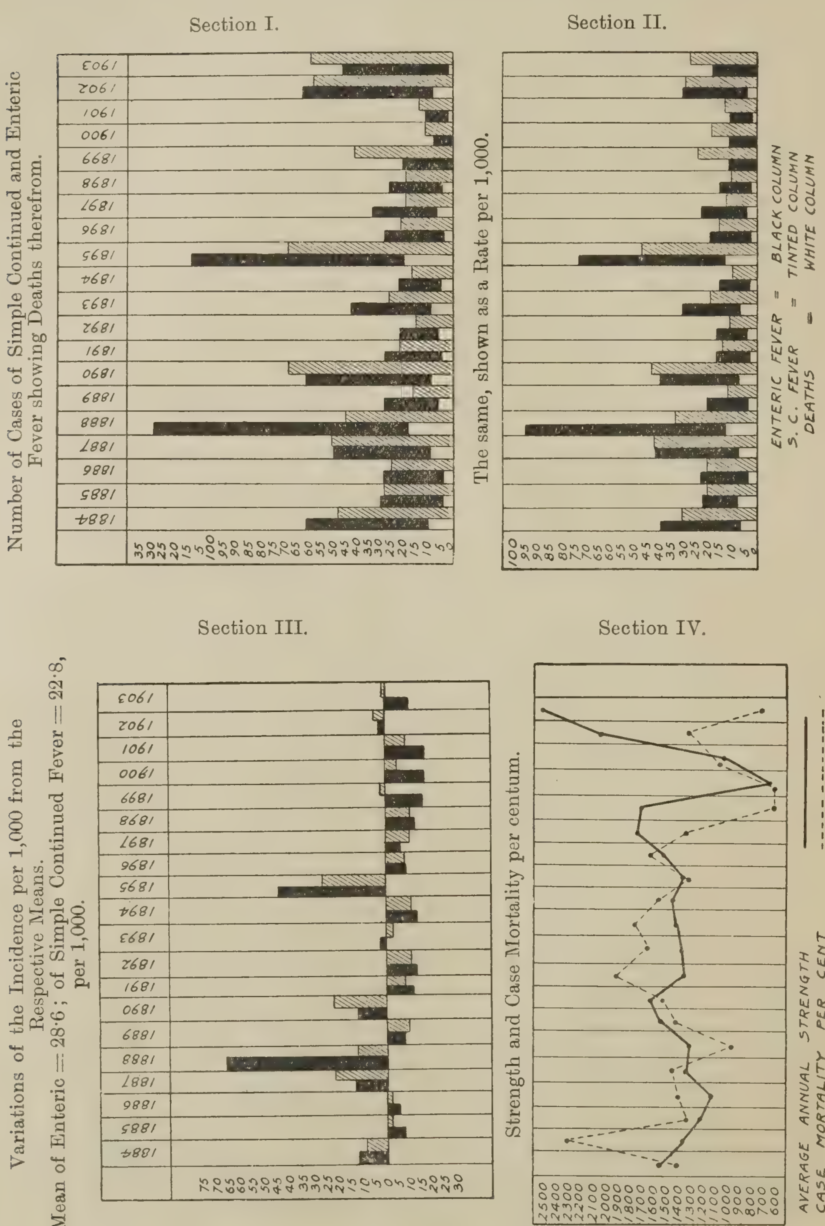
the square root of the sum of the squares of the apparent errors by the number of terms. It may be remembered that in comparing groups of observations their relative value is as the reciprocal of the squares of their probable errors.

Diagram No. 1.—General Prevalence and Mortality of the Continued Fever during the Period 1884 to 1903, among the Troops Stationed at Bermuda.



I would venture the suggestion that the true reason is that when enteric fever is very prevalent many cases would receive that diagnosis which ordinarily would be returned as simple continued fever.

In the diagram referred to, which is constructed from Table A, Section I. gives the number of actual cases of enteric fever and simple continued fever, with the deaths (all of which were from enteric fever). Section II. gives the same, shown at a rate per 1,000; and Section III. shows the variation of the incidence per 1,000 from the respective means. Section IV. gives the numbers of the garrison, and the military case mortality, counting only the cases returned as enteric fever.

From Section III. it appears that the years when enteric fever was above the average were 1884, 1887, 1888 (very severe epidemic), 1890, 1893 (very slightly above the average), 1895 (very severe epidemic), and 1902. These dates synchronise fairly well with those of the arrival of fresh battalions and drafts.

The 2nd York and Lancaster arrived in November, 1883, with a company of the Royal Engineers, both from England.

In 1886, two batteries of Royal Artillery and the 2nd West Riding Regiment arrived from England in October.

The great epidemic of 1888 occurred immediately on the arrival of 1st Battalion Leicester Regiment on September 22nd, from England.

In 1890, the Grenadier Guards arrived from England.

In 1893, the 1st Royal Berkshire Regiment arrived in March, from Malta.

In 1895 the disease does not appear to have any connection with the arrival of a new battalion. The 2nd Leinster Regiment arrived in November of that year, but the epidemic commenced in July. A large draft must have arrived, as out of the total of 107 cases which occurred, no less than forty-seven, with eleven deaths, were among men with less than one year's service in the command.

In 1902 the disease was certainly imported from South Africa with the 2nd Battalion Royal Warwick Regiment and Boer prisoners of war, while the 4th Battalion Worcester Regiment, composed of very young soldiers from home, gave most cases of the disease.

This accounts for every battalion that has been in garrison, except the King's Liverpool Regiment, which arrived in 1891, and the 2nd Worcester Regiment in 1897. Both these battalions came from Malta, the same station that the 1st Royal Berkshire Regi-

ment came from in 1893, when, as already noticed, the incidence of enteric was only just above the average. No battalions have come to Bermuda except those from England and Malta.

It would therefore appear that practically every battalion from England has suffered considerably. Those from Malta have been less liable to the disease. The annual prevalence, therefore, appears to depend upon the length of time the majority of the garrison have been stationed in Bermuda, and upon the locality in which they last served, which is quite in accordance with the usual experience at other stations. I have not included a table showing the whole of the arrivals, on account of exigencies of space.

There has been a very decided decrease in the prevalence of enteric fever during recent years, which is doubtless due to improved sanitary arrangements in barracks, and especially to the introduction of the water carriage system of sewage removal.

I think the evidence goes to prove that the disease was chiefly due to drinking impure water and to food contaminated by flies from infected latrines. Owing to insanitary conditions in the lower class houses occupied by civilians, some cases are bound to occur among soldiers, however excellent the sanitary arrangements may be in barracks. It will, however, be noticed that when severe epidemics have occurred among the troops there has not been any corresponding increase in the number of deaths among the civil population.

When any insanitary condition has not been found in barracks, there has always been a tendency to blame the civil population, and certainly at times with but little justification. For instance, in the Army Medical Department Reports for 1886, the then Principal Medical Officer says: "While there is no appreciable cause for this disease within military limits, the highly insanitary condition of the civil surroundings, and the continued prevalence of the disease among the civil residents, lead to the belief that it is contracted by the troops from outside barracks." Yet next year it was discovered that the officers' mess tank was largely used by the men, as the water had a reputation for purity. "This tank had not been cleaned out for a long time, and its surroundings were bad." It was near a stable and a latrine. The water was found to be of a suspicious nature. "The tank was closed at the end of October, after which date . . . . there has been an absence of enteric fever."

At St. George's, also, cases were occurring; a tank appeared to be in bad repair, was closed, and "the disease ceased to appear."

Again in 1894, "The whole of the Prospect drains require overhauling."

In 1898, "the most severe cases were attributed to infection at Warwick Camp. The disease is generally attributed to the dry earth system. The marked decline in the prevalence of enteric fever in Bermuda is attributed to the custom of closing and disinfecting latrines which have been used by patients suffering from enteric fever previous to their admission, to the careful supervision of sanitary details, to the boiling of drinking water, and disinfection of water barrels with perchloride of mercury, and to the extension of the water carriage system of sewage disposal."

In 1900, "The careful supervision of sanitary details, to which the decline of enteric fever has been attributed, is still consistently carried out with satisfactory results; but the main feature of the decline is its coincidence with the gradual replacement of the dry earth system of conservancy by a water carriage system."

The absence of enteric fever among the troops stationed at Boaz and Ireland Island has often called forth remarks. Giving evidence before the Committee of 1889, the Principal Medical Officer stated that he did not consider Ireland Island came within the endemic area. The Army Medical Department Report for 1890 gives, however, a more satisfactory reason: "The men are quartered on a point of the Island with free exposure to the wind in all directions, and have little or no communication with the insanitary towns on the mainland."

In 1901 Boer prisoners of war arrived, being placed on various islands in the Great Sound. They were guarded by men of the Royal Warwick Regiment from South Africa and the Worcester Regiment, composed largely of young soldiers from home. In 1902 enteric assumed the proportions of an epidemic, the cases among the soldiers being treated at Watford, while men from the islands were in garrison at Boaz. Coincidently the naval dockyard extension works commenced; hundreds of West Indian negroes were imported. These men lived (under insanitary conditions) at Somerset, crossing daily to Ireland Island, passing *en route* Watford Hospital and the barracks on Boaz.

A little later work commenced on the new swing bridge over the channel between Watford and Somerset. Thus the disease was introduced, and the "communication with the insanitary towns on the mainland" opened up at the same time. The tables show the result to the Navy, the figures leaping at a bound from an average approximating to the unavoidable rate of the civil population to one seven times as great.

It might be mentioned that in the year 1893 half the naval cases of enteric were landed from a man-of-war, and were not contracted in Bermuda. The statistics are for all cases treated at the Royal Naval Hospital, so the true local rate is less than that given. In 1902 and 1903 all the cases were contracted locally. One of the cases was a petty officer of H.M.S. "Hotspur," who went to Somerset on one occasion only, and while there drank a bottle of soda water of local manufacture. For these facts I am indebted to the medical officer of the ship.

Generally speaking, Prospect is in a very fair sanitary condition; all the men are quartered in well built barracks. They have plenty of walks without going to Hamilton, and when they go, they visit houses in a fair sanitary state. The conditions are different at Boaz, the men have inferior accommodation, there is nowhere for them to walk except to Somerset, the insanitary condition of which I have already referred to. These facts, I think, account for the greater prevalence at Boaz compared to Prospect, where few, if any, cases originated.

Warwick Camp, too, continues to afford a considerable number of cases, due doubtless to the sanitary defects of the camp and the locality, and in part no doubt to the inferior ventilation of tents.

As a large number of men at Boaz were under canvas in 1902 and 1903, this cause may have influenced them as well, although I was unable to trace any greater incidence among the troops in tents than among the men occupying the barracks or the huts.

C.—Case Mortality.

The case mortality experienced in Bermuda for the last twenty years has been worked out in Section I of Table B.[1] It varies from 34·37 in 1885 (counting the cases in the Army and Navy together) to 1·32 in 1903 (76 cases with 1 death), and *nil* (24 cases without a death) in 1899. If the number of cases returned as simple continued fever be included, the resulting case mortality is much reduced, varying from 16·93 in 1885 to 0·69 in 1903, when cases in both Army and Navy are included.

[1] Table C shows 168 deaths out of the 1,118 cases, or 15·03 per cent. Applying Poissou's formula to calculate the relative value of this rate, the variation would be $\pm\ 2 \frac{\sqrt{2 \times 168 \times 950}}{(1118)\ 3} = \pm\ 2\ \sqrt{\cdot 000229} = \pm\ 0{\cdot}03$ compared to unity, or $\pm$ 3 per cent. So the true case mortality might vary between 18 and 12 per cent.

TABLE B.—RELATIVE PREVALENCE AND MORTALITY.

Section I.—Case Mortality for Enteric and Continued Fevers in Army and Navy in Bermuda.

	Enteric Fever			Continued Fevers		
Year	Army only	Navy only	Navy and Army	Army only	Navy only	Army and Navy
1884	16·13	25·00	16·66	9·09	11·11	9·24
1885	34·48	50·00	34·37	17·54	12·50	16·93
1886	14·29	33·33	16·13	7·55	6·66	7·35
1887	16·00	Nil	14·74	7·02	Nil	7·55
1888	14·06	Nil	14·00	10·40	Nil	10·17
1889	22·22	Nil	20·69	14·00	Nil	9·83
1890	16·13	50·00	18·18	7·63	18·18	8·45
1891	18·52	Nil	17·85	14·17	Nil	9·61
1892	27·27	33·33	28·00	16·21	4·16	11·47
1893	20·93	7·77	17·86	11·40	2·70	9·43
1894	22·73	Nil	20·00	13·16	Nil	9·26
1895	18·69	Nil	18·35	11·36	Nil	11·11
1896	14·81	25·00	16·13	8·33	12·50	8·93
1897	20·59	Nil	18·42	13·21	Nil	10·08
1898	15·58	12·50	14·70	8·88	12·50	9·43
1899	Nil	Nil	Nil	Nil	Nil	Nil
1900	Nil	11·11	6·25	Nil	10·00	3·57
1901	9·09	Nil	5·88	4·17	Nil	3·12
1902	14·29	7·00	11·32	7·50	6·25	7·74
1903	2·17	Nil	1·32	0·94	Nil	0·69
1884 to 1903..	16·29	8·72	15·15	9·06	4·38	8·29

Section II.—Relative Prevalence in Bermuda and elsewhere.

Place	Period	Admissions	Deaths	Ratio per 1,000		Case Mortality per cent.
				Admissions	Deaths	
South Africa[1] ..	1884 to 1896	421	83	9·82 ± 1·35	1·93 ± 0·59	19·71
India[2]	Decennial average 1879 to 1888	584	184	9 8	3·14	31·51
India[2]	Decennial average 1889 to 1898	1,632	432	24·1	6·38	26·47
India[1]	1886 to 1895	12,939	3,474	19·22 ± 0·47	5·16 ± 0·24	26·85
United Kingdom[1] ..	1887 to 1896	1,276	357	1·27 ± 0·10	0·26 ± 0·04	27·98
Bermuda (Army) ..	1884 to 1903	841	137	28·6 ± 3·14	4·66 ± 0·55	16·29
Bermuda (Navy) ..	1884 to 1901	76	10	2·9 ± 0·29	0·37 ± 0·07	13·16
Bermuda (Army) ..	1884 to 1893	478	86	34·55 ± 5·40	6·20 ± 0·54	18·00
Bermuda (Army) ..	1894 to 1903	363	51	22·86 ± 2·07	3·29 ± 0·82	14·05
Bermuda (1,000 cases)	1879 to 1903	1,000	156	22·9	3·80	15·60
Bermuda (Civilians)	1884 to 1903	(?)	120	(?)	0·37 ± 0·02	(?)

[1] Army Medical Department Report for 1898, p. 492.
[2] ,, ,, ,, 1900, p. 415.

In the last column of Section II. the case mortality in India, South Africa, and the United Kingdom are compared with those experienced in Bermuda, by which it would appear that the disease is on the average less fatal in Bermuda than elsewhere.

Dr. Osler, in his work, "The Principles and Practice of Medicine," published last year, gives the following case mortalities:—

South African War to March, 1901	20·9 per cent.
Maidstone Epidemic	7 to 8 ,,
Private Practice	5 ,, 17 ,,
Hospital Practice	7 ,, 20 ,,

In 1902 in Bermuda 185 cases were reported to the Medical Officer of Health, with 4 deaths, or 2·16 per cent., which is practically the same as the Army rate for 1903 (2·17 per cent.)

D.—Relative Prevalence and Mortality.

The relative prevalence and mortality is shown in Section II. of Table B. The prevalence in Bermuda has decreased in the decennial period 1894 to 1903, being about two-thirds of the rate for the preceding decennial period, while the mortality rate has fallen by about a half. The rates have been calculated for different periods in Bermuda, but taking the rate for the twenty years 1884 to 1903 (which is a purely military rate) as the standard, it appears that the prevalence in Bermuda is three times greater than in South Africa (1884 to 1896); one and a half times greater than in India (1886 to 1895); eleven times greater than among the naval forces prior to 1902; and twenty-two times greater than in the United Kingdom. While the death-rate is practically the same as in India, taking into account the probable errors; twice as great as that in South Africa; not less than thirteen times greater than in the United Kingdom; and about ten times greater than the local rate among the civil population, and the Navy before 1902.

It will be noticed that these last are either practically equal to the United Kingdom rate, or twice as much, according to the addition or subtraction of the probable error. I think it may justifiably be considered the unavoidable death-rate. The combined death-rate of Army and Navy in 1903 is the very satisfactory one of 0·23 per 1,000 of strength.

TABLE C.—ADMISSIONS AND DEATHS DUE TO ENTERIC FEVER MONTHLY,

With the respective Monthly Percentages.

Years	Average Annual Strength	January Admissions	January Deaths	February Admissions	February Deaths	March Admissions	March Deaths	April Admissions	April Deaths	May Admissions	May Deaths	June Admissions	June Deaths	July Admissions	July Deaths	August Admissions	August Deaths	September Admissions	September Deaths	October Admissions	October Deaths	November Admissions	November Deaths	December Admissions	December Deaths	Totals Admissions	Totals Deaths
1877	1,874	—	—	—	—	—	—	—	—	1	—	—	—	—	—	1	—	5	1	—	—	4	—	1	—	12	1
1878	2,017	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	1	—	—	3	—	2	—	2	—	9	1
1879	1,970	—	1	—	—	—	—	—	—	—	—	4	—	—	—	1	—	2	1	1	—	2	—	2	—	12	2
1880	1,974	2	—	3	—	2	1	—	—	—	—	—	—	2	—	2	1	2	2	9	1	1	1	4	—	27	6
1881	1,573	6	3	1	—	—	—	1	—	—	—	—	—	—	—	1	—	1	—	1	—	—	—	2	—	13	3
1882	1,446	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	3	—	4	—	10	2	21	2
1883	1,434	—	1	—	—	1	—	—	1	1	—	1	—	—	—	—	—	—	—	—	—	1	—	6	1	10	3
1884	1,551	1	1	2	—	—	—	—	—	—	—	—	—	—	—	3	1	3	1	15	1	19	2	19	4	62	10
1885	1,385	12	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	1	10	3	4	1	1	1	29	10
1886	1,227	—	—	—	—	—	—	—	—	—	—	1	—	1	—	6	1	—	2	4	—	4	—	12	1	28	4
1887	1,183	11	3	4	1	3	—	2	1	—	—	—	—	2	—	3	1	2	—	9	1	9	1	5	—	50	8
1888	1,346	1	—	—	—	—	—	—	—	—	—	—	—	1	—	1	—	5	1	36	4	43	8	41	5	128	18
1889	1,320	12	4	7	1	1	—	1	—	—	—	1	—	—	—	—	—	—	—	1	—	3	1	1	—	27	6
1890	1,546	—	—	—	—	—	—	—	—	—	—	1	—	6	1	6	3	18	3	15	1	13	1	3	1	62	10
1891	1,610	1	—	—	—	—	—	—	—	—	—	1	—	3	1	3	1	4	1	8	—	3	1	4	1	27	5
1892	1,363	3	—	1	1	—	1	—	—	—	—	1	—	3	2	5	—	3	1	5	1	—	—	1	—	22	6
1893	1,390	—	—	—	—	—	—	—	—	—	—	5	—	12	3	6	2	4	—	11	2	3	1	1	1	42[1]	9
1894	1,410	1	1	—	1	—	—	—	—	—	—	1	1	1	—	6	—	3	1	4	—	2	1	4	—	22	5
1895	1,447	1	3	—	—	—	—	—	—	—	—	15	—	18	5	24	6	14	—	8	4	12	1	15	1	107	20
1896	1,387	4	1	2	—	—	—	—	1	—	—	1	—	9	—	2	—	3	1	1	—	1	—	4	1	27	4
1897	1,521	—	2	—	—	—	—	—	—	—	—	—	—	14	1	3	1	4	1	5	—	4	1	4	1	34	7
1898	1,730	3	—	—	1	—	—	—	—	—	—	1	—	4	1	4	—	5	—	4	2	2	—	4	—	27[2]	4
1899	1,700	—	—	—	—	—	—	—	—	—	—	2	—	6	—	2	—	3	—	4	—	2	—	1	—	20	Nil[3]
1900	632	1	—	1	—	—	—	—	—	—	—	—	—	1	—	3	—	—	—	—	—	2	—	—	—	8	Nil
1901	1,014	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	3	—	3	—	3	1	11	1
1902	2,051	3	—	2	2	—	—	—	—	3	—	4	2	4	—	25	1	8	2	5	—	8	2	1	—	63	9
1903	2,577	3	—	—	—	1	—	1	—	—	—	2	—	2	—	10	—	10	—	6	1	6	—	5	—	46	1
1904	2,867	4	—	1	—	—	—	—	—	2	—	1	—	1	1	4	—	17	—	19	4	7	2	12	1	68	8
Totals	44,545	73	24	24	7	8	2	5	3	7	—	42	3	90	15	124	19	119	19	190	25	164	24	168	22	1,014	163
1898 to 1903	Royal Navy and Dockyard, Ireland Island	9	—	6	1	1	1	1	—	2	—	1	—	8	—	18	2	14	—	15	—	24	1	5	—	104	5
Grand totals ..		82	24	30	8	9	3	6	3	9	—	43	3	98	15	142	21	133	19	205	25	188	25	173	22	1,118	168
Monthly percentages ..		7·33	14·28	2·68	4·76	0·80	1·79	0·54	1·79	0·80	0·00	3·84	1·79	8·77	8·92	12·70	12·50	11·90	11·31	18·35	14·88	16·82	14·88	15·47	13·10	100·00	100·00

[1] 43 are shown in the Army Medical Department Report.

[2] 26 are shown in the Army Medical Department Report.

[3] Owing to the war in South Africa, the garrison was denuded of European infantry from the autumn of 1899 until the middle of 1901.

TABLE D.—SEASONAL PREVALENCE.

Monthly Admissions as a Ratio per 1,000 *of Strength for the Two Decennial Periods* 1884 *to* 1893 *and* 1894 *to* 1903.

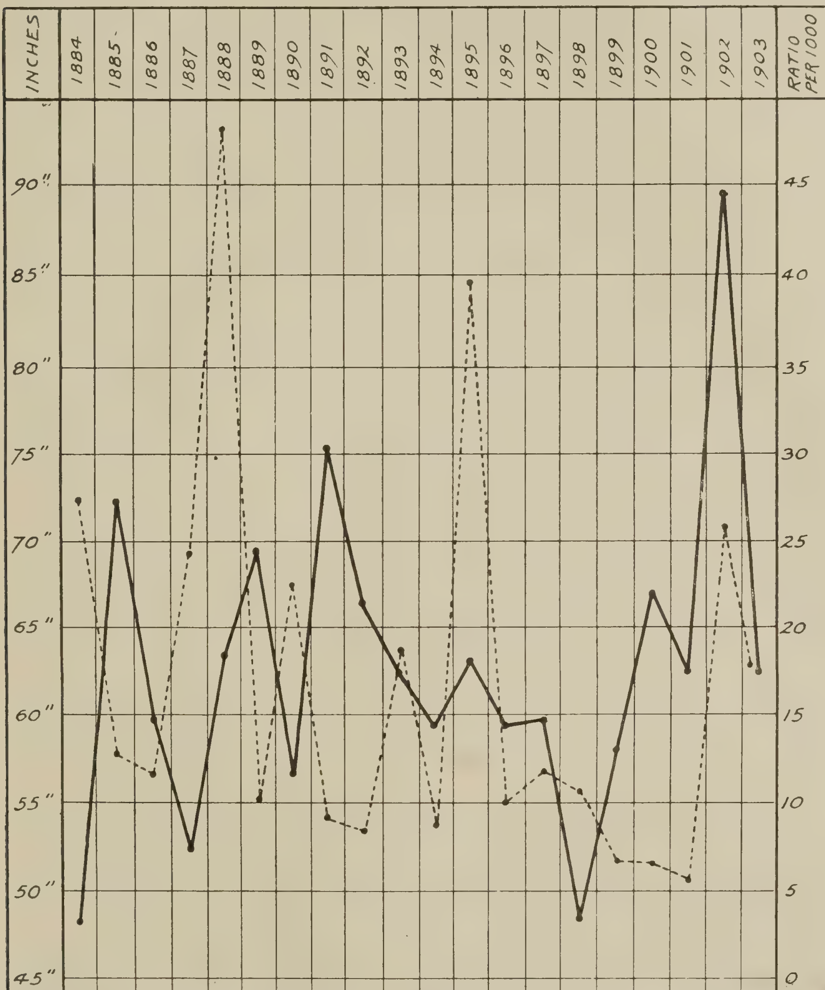
	January	February	March	April	May	June	July	August	September	October	November	December	Ratio per 1,000 of Strength per Annum
1884	0·64	1·29	—	—	—	—	—	1·93	1·93	9·67	12·27	12·27	40·0
1885	8·65	—	—	—	—	—	—	—	1·44	7·21	2·88	0·72	20·9
1886	—	—	—	—	—	0·81	0·81	4·89	—	3·25	3·25	9·79	22·8
1887	9·29	3·37	2·53	1·68	—	—	1·68	2·53	1·68	7·61	7·61	4·22	42·2
1888	0·74	—	—	—	—	—	0·74	0·74	3·71	26·75	31·95	30·47	95·1
1889	9·10	5·32	0·76	0·76	—	0·76	—	—	—	0·76	2·28	0·76	20·5
1890	—	—	—	—	—	0·65	3·88	3·88	11·64	9·70	8·41	1·94	40·1
1891	0·62	—	—	—	—	0·62	1·87	1·87	2·51	5·03	1·87	2·51	16·9
1892	2·20	0·74	—	—	—	0·74	2·20	3·64	2·20	3·64	—	0·74	16·1
1893	—	—	—	—	0·72	3·60	8·61	4·31	2·88	7·90	2·16	0·72	30·9
Average	3·124	1·072	0·329	0·244	0·072	0·718	1·979	2·379	2·799	8·152	7·268	6·414	34·55
1894	0·71	—	—	—	—	0·71	0·71	4·24	2·13	2·84	1·42	2·84	15·6
1895	0·69	—	—	—	—	10·36	12·44	16·59	9·66	5·52	8·28	10·36	73·9
1896	2·89	1·44	—	—	—	0·72	6·51	1·44	2·17	0·72	0·72	2·89	19·5
1897	—	—	—	—	—	—	9·21	1·98	2·64	3·29	2·64	2·64	22·4
1898	1·80	—	—	—	—	—	2·40	2·40	3·00	1·80	1·20	2·40	15·0
1899	—	—	—	—	—	1·18	3·54	1·18	1·77	2·36	1·18	0·59	11·8
1900	1·59	1·59	—	—	—	—	1·59	4·74	—	—	1·59	—	11·1
1901	0·98	—	—	—	—	—	—	0·98	0·98	3·94	0·98	2·94	10·8
1902	1·46	0·97	—	—	0·48	2·92	0·97	12·25	3·88	1·95	4·85	0·97	30·7
1903	1·17	—	0·39	0·39	—	0·78	0·78	3·85	3·85	2·32	2·32	1·95	17·8
Average	1·129	0·400	0·039	0·039	0·048	1·667	3·815	4·965	3·008	2·474	2·518	2·758	22·86

Section III.—Seasonal Prevalence.

The statistics showing the admissions for enteric are available month by month from 1877, as shown in Table C.[1] In Table D I have calculated the monthly ratios per 1,000 of strength from 1884, dividing them into two decennial periods for purposes of comparison. It will be noticed that the enteric season may be said to commence in May and terminate in April. The greater

[1] This table was prepared at the suggestion of Lieutenant-Colonel Simpson, after the Report was in print and eight months after it was written. I have, therefore, included the figures for the Army in 1904. The monthly percentages are also given both for admissions and deaths.

DIAGRAM No. 2.—INCIDENCE OF ENTERIC FEVER SHOWN AS A RATIO PER 1,000 OF STRENGTH AMONG THE MILITARY AND NAVAL FORCES AT BERMUDA, FROM 1884 TO 1903, WITH THE RAINFALL.



	1884	1885	1886	1887	1888	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902	1903
RAINFALL INCHES	48·50"	72·17"	59·73"	52·31"	63·85"	69·51"	56·90"	75·09"	66·46"	62·44"	59·59"	63·10"	59·38"	59·40"	48·19"	57·91"	67·03"	62·61"	89·24"	62·14"
RATIO PER 1000	27·15	12·80	11·71	24·13	48·13	10·02	22·59	9·08	8·55	18·73	8·90	39·68	10·01	11·96	10·62	6·75	6·42	5·63	25·97	17·35

RAINFALL ————————
ENTERIC FEVER - - - - - - - - - -

prevalence in the first decennial period is chiefly due to the large number of cases in October, November and December. It would be exceedingly useful if it were possible to state definitely the cause of this difference. In the first decennial period the ratios compare as follows with those of the second period. The months with an excess are: January + 1·995, February + 0·672, March + 0·290, April + 0·205, May + 0·024, October + 5·678, November + 4·750, and December + 3·656, a total of + 17·270; while there is a decrease in June — 0·949, July — 1·836, August — 2·586, and September — 0·209, a total of — 5·580; thus accounting for the difference between the two ratios of 11·69.

It will be at once noticed that the cases were more numerous, relatively, in the summer months during the second period, while in the first period the disease was much more prevalent in the autumn. If the excess in the autumn in the first period accounted altogether for the difference in the ratios, there would have been good grounds for the argument that some cause of disease had been removed, and thus did not affect the health of the troops in the autumn. Unfortunately, it is also necessary to account for the increase in the summer during the second period.

In order to throw light upon this question Diagram 2 was constructed. There is a very general opinion among the local medical men in Bermuda that the incidence of enteric fever varies with the rainfall. In earlier Army Medical Department Reports, year after year the same view is held. The evidence would therefore seem to show that formerly in the Army, and usually among the civil population, a heavy rainfall coincided with a heavy incidence of enteric in the autumn.

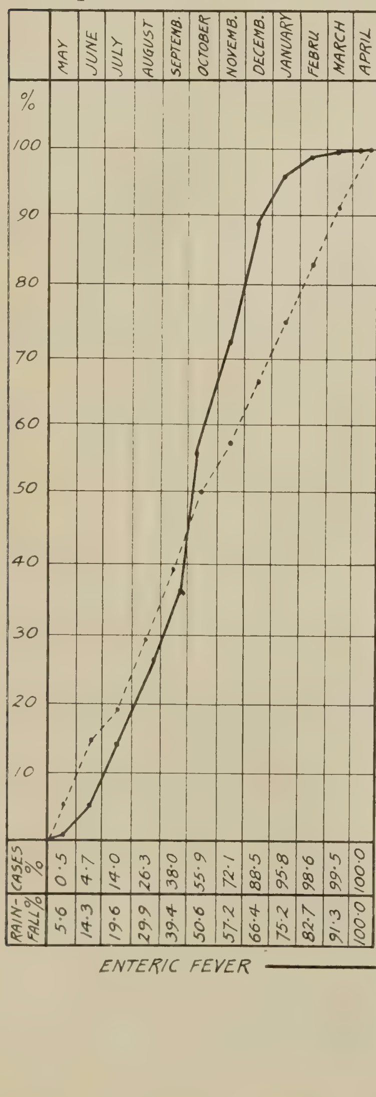
Diagram No. 2 gives the ratios per 1,000 of strength of Army and Navy combined, with the rainfall in inches. I can trace no connection between the resulting curves except in 1902, when the result appears accidental. Yet, while the total rainfall might not affect the disease, the monthly rainfall might do so.

Diagram No. 3 has been drawn from the monthly prevalence of 1,000 cases of enteric which occurred in the Army from 1879 to 1903, and the Navy in 1902 and 1903. It is drawn up on the model of the Diagram No. 8, Sections III., IV. and V., Appendix XI., Army Medical Department Reports for 1898, by Lieutenant-Colonel Simpson, and can usefully be compared, as there is such a marked difference in the curves. Colonel Simpson's conclusively show the connection of the incidence of enteric and the rainfall, the one line having a close relationship to the other. In my diagrams such a connection is not very obvious.

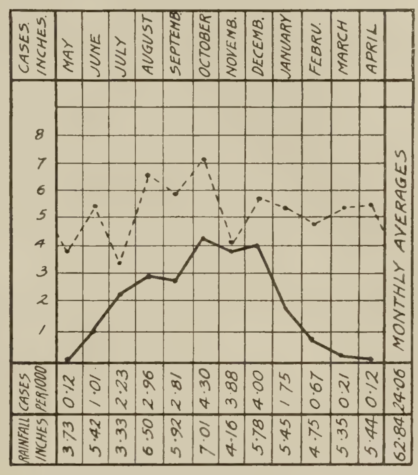
Diagram No. 3.—Seasonal Prevalence.

Averages and Percentages calculated from 1,000 Cases of Enteric Fever which occurred in Bermuda between 1879 and 1903 and the Rainfall during the years 1894 to 1903.

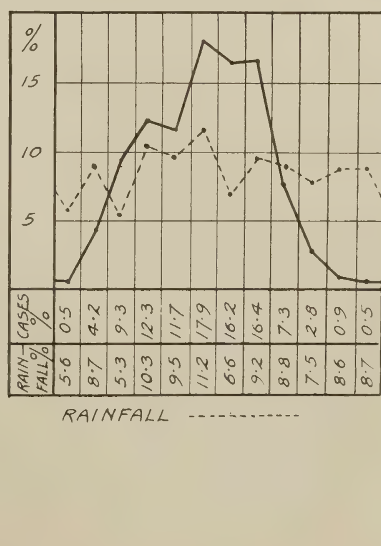
I.—Distribution. Each figure shows the sum of the percentages in all the previous months.



II.—Monthly Averages. Enteric cases as a ratio per 1,000 of strength and rainfall in inches.



III.—Percentages by months of enteric cases and of the rainfall.



ENTERIC FEVER ———— RAINFALL ------------

Section I., distribution, is taken from the figures in Section III., percentages, only "each ordinate shows the sum of the percentages in all previous months." In Section II. monthly averages are taken instead of percentages.

In Section III. the rise of the enteric curve does not appear to have any connection with that of the rainfall; but there is a slight similarity from August to December. Thus they both rise in August and fall in September, rise again in October and fall in November, again rising together in December. After December there does not appear to be any similarity whatever.

As already remarked, the ratios for the second decennial period in Table D show less enteric during these months; Diagram No. 4 was consequently prepared from that table, revealing very marked changes in the resulting curves.

That the rise in the first decennial period represented by the thick black line is due to the rainfall in August, September and October, appears to be very probable, particularly as this is the frequently expressed opinion of competent observers; but it is difficult to trace any connection whatever between the thin black line representing enteric during the second period and the rainfall curve.

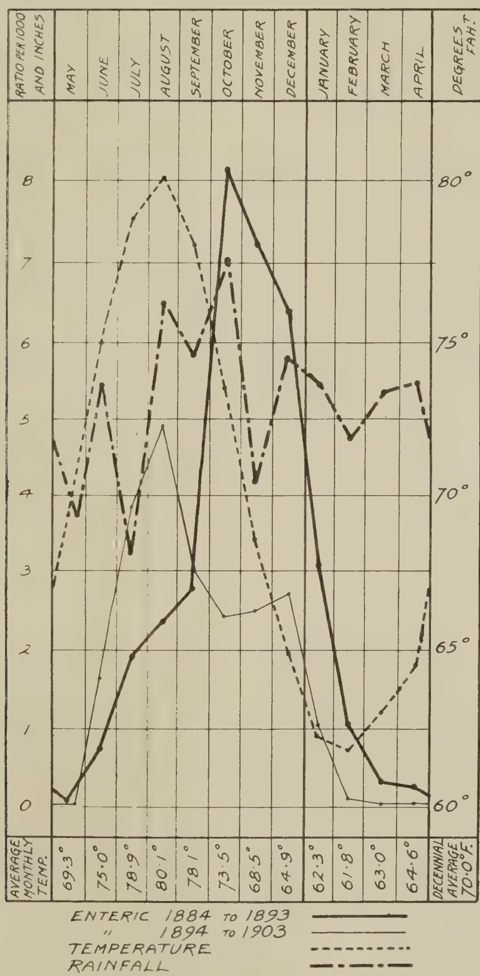
I have introduced, however, as a dotted line, the curve for the average monthly temperatures, and I venture to think that a certain relationship is at once disclosed, a relationship still more clearly manifested in Section III. of Diagram No. 8.

Enteric fever has always been considered an autumnal fever in Bermuda, as in other temperate climates, and it has been pointed out that its seasonal variation is the same as in the United States of America, where it is called the "fall" or autumnal fever. It certainly has not been an autumnal fever during the last ten years among the soldiers. Assistant Surgeon W. G. Don, Royal Engineers (the present Deputy Surgeon-General Don), in his paper of 1869, remarks that "both simple continued and the enteric forms of fever in Bermuda" depend upon summer heat, but when once started they do not die down immediately the heat is over. These remarks would, I think, be perfectly descriptive of the state of affairs now existing, but not of that of the first decennial period. Hence it appears probable that some secondary cause, which became added to the summer heat, the original cause, has recently been removed. That secondary cause depends on the rainfall, and consequently must be a contaminated water supply.

The difficulties of an absolute proof are enhanced by the fact

that at Boaz and Warwick Camp, the sanitary conditions of the previous decennium are still to be found; if not actually in the camps, then in the immediate vicinity.

Diagram No. 4.—Showing Incidence of Enteric by Months during the Two Decennial Periods 1884 to 1893 and 1894 to 1903, with the Monthly Mean Temperature and Rainfall during the Decennial Period 1894 to 1903.

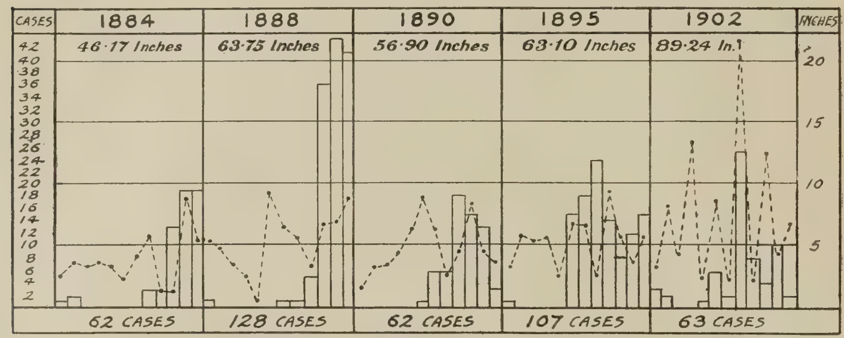


There remains the excess of the ratio of the second period during the summer months, and I think this may be explained to some extent on the theory that of a certain number of susceptible

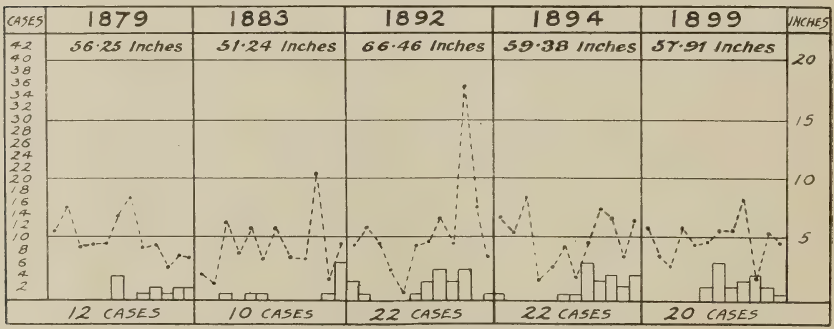
individuals, some are bound to take the disease on the first opportunity. Arriving in the autumn in accordance with the custom of the service, the soldier escapes contracting the disease, as the water is pure; but next summer he is exposed to contagion and succumbs.

Diagram No. 5.—Seasonal Prevalence.

Five Years of Maximum Prevalence of Enteric Fever contrasted with Five Years of Minimum Prevalence, showing the Number of Cases, and the Rainfall by Months.[1]



Section I.—Five Years of Maximum Prevalence.



Section II.—Five Years of Minimum Prevalence.

Surgeon-General Charlton, who was the Principal Medical Officer of Bermuda during the epidemic of 1902, was strongly of opinion that flies and dust were the means of infection, and not the rainfall, In Bermuda the roads dry so quickly that twenty-four hours after a heavy downpour the roads would be as dusty as before. No doubt the curve representing the temperature also represents the prevalence of flies and dust.

[1] The outline representing the admissions in 1902 is slightly inaccurate, the correct one is shown in Diagram No. 6.

Diagram No. 6.—Showing Incidence of Enteric and Simple Continued Fevers by Months during the Five Years 1899 to 1903.

Diagram No. 7.—Variations from the Means of the Decennial Period 1894 to 1903 shown Monthly for the Five Years 1899 to 1903.

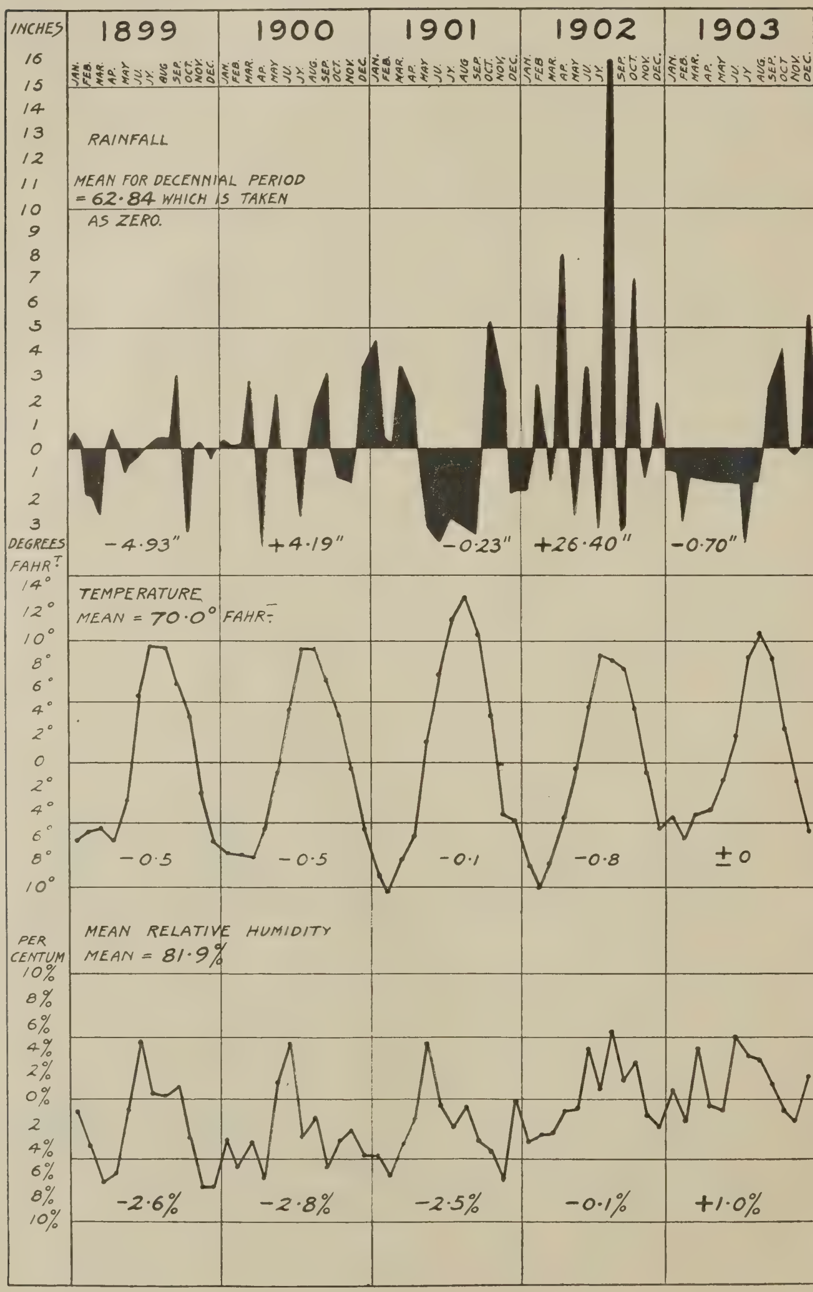
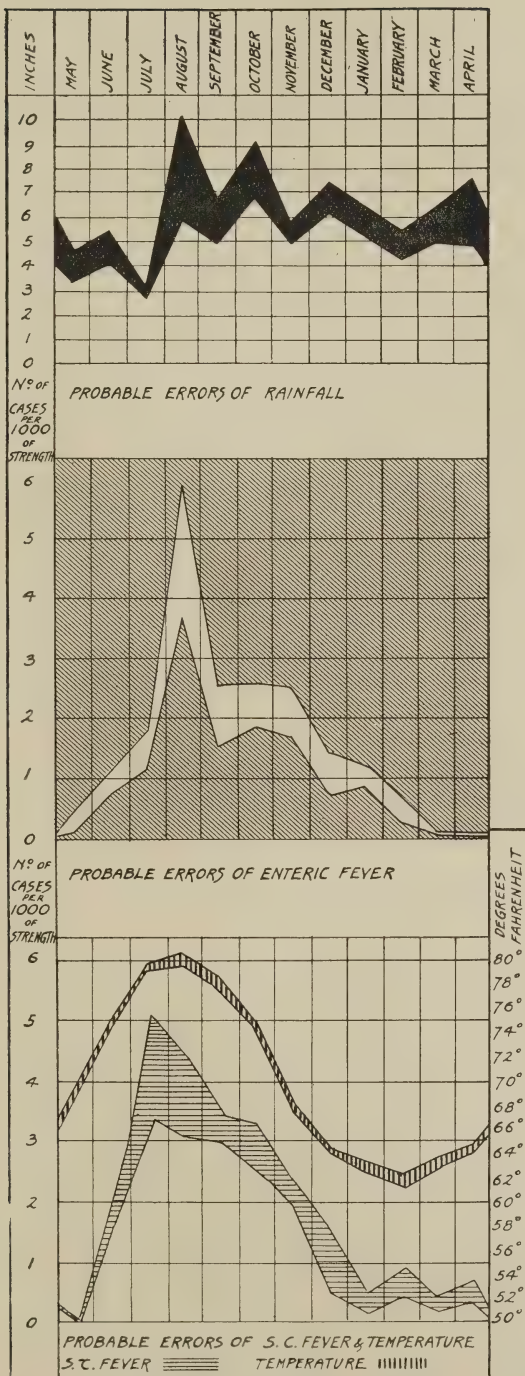


Diagram No. 8.



INCHES
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
JANUARY
FEBRUARY
MARCH
APRIL
10
9
8
7
6
5
4
3
2
1
0
Nº OF CASES PER 1000 OF STRENGTH
PROBABLE ERRORS OF RAINFALL
6
5
4
3
2
1
0
Nº OF CASES PER 1000 OF STRENGTH
PROBABLE ERRORS OF ENTERIC FEVER
DEGREES FAHRENHEIT
6
5
4
3
2
1
0
80°
78°
76°
74°
72°
70°
68°
66°
64°
62°
60°
58°
56°
54°
52°
50°
PROBABLE ERRORS OF S. C. FEVER & TEMPERATURE
S. C. FEVER
TEMPERATURE

To throw still further light upon the rainfall as a cause, I prepared Diagram No. 5, which shows the actual number of admissions, and the rainfall by months, for the five years of maximum and minimum prevalence.

Simple continued fever has only been shown by months for the past five years, I have therefore prepared Diagram No. 6, comparing the admissions with enteric fever. As it was shown in Section I. that simple continued fever varied proportionately from year to year with enteric fever, so this diagram shows, I think, that it varies proportionately by months. There is, however, this fact to be noticed, that the cases diagnosed simple continued fever reach their maximum the month before the enteric maximum. This can no doubt be accounted for by the greater readiness to diagnose mild cases as simple continued fever at the commencement of each yearly epidemic, while later, when cases of marked enteric fever are being treated, doubtful cases are more likely to be recognised.

Diagram No. 7 is the complement to the previous one, showing the curves of rainfall, temperature and mean relative humidity, while Diagram No. 8 combines these curves into one, showing also the probable errors. The likeness of the enteric curve to that of simple continued fever and the temperature is very marked, as is also the fact that the simple continued fever curve rises to the maximum a month before the enteric curve.

I have not given tables showing the rainfall, temperature, or relative humidity, as they can easily be seen month by month in the Army Medical Department Reports, nor have I considered it necessary to give the actual figures of the probable errors, on account of exigencies of space.

Section IV.—The Influence of Age and Service.

A.—The Influence of Age.

Table E has been constructed by combining Table VII. of Lieutenant-Colonel Simpson's Report with similar calculations for Bermuda. This has been done to facilitate comparison. To quote Colonel Simpson's description of his table:—

"If we divide the proportion of total cases which occurred in a certain age group by the proportion of the total population falling in that same age group, we shall obtain a ratio (L) which will express the liability of men of that age group to the disease in question, and so shall be able to compare the incidences in popula-

TABLE E.—RELATIVE LIABILITY BY AGE GROUPS.

The Figures for Maritzburg, India and the Metropolitan Asylums Board are taken from Table VII., Appendix VI., Army Medical Department Reports for 1898, *by Major Simpson.*

I.—ADMISSIONS.

Place	Under 25				Under 20				20 to 25				25 to 30				Over 30				Over 25			
	P.	A.	L.	R.	P.	A.	L.	R.	P.	A.	L.	R.	P.	A.	L.	R.	P.	A.	L.	R.	P.	A.	L.	R.
Maritzburg, January, 1891, to June, 1898	56·3	70·1	1·24	100	4·8	4·0	0·83	67	51·5	66·1	1·28	103	33·5	27·2	0·81	65	7·0	2·2	0·31	25	40·5	29·4	0·73	59
India, 1879 to 1888	44·7	59·4	1·32	100	3·6	—	—	—	—	—	—	—	33·9	24·7	0·73	55	13·7	9·0	0·66	50	47·6	33·7	0·71	54
Metropolitan Asylums Board, 1890 and 1891	19·9	38·2	1·92	100	10·3	23·0	2·23	116	9·6	15·2	1·58	82	—	—	—	—	—	—	—	—	15·7	15·7	1·0	52
Bermuda, 1895 to 1903 ..	57·9	65·4	1·13	100	7·8	5·0	0·64	57	50·1	60·4	1·20	107	29·1	27·3	0·90	80	13·0	7·3	0·56	50	42·1	34·6	0·82	72

II.—DEATHS. PERCENTAGE OF TOTAL DEATHS BY AGE GROUPS.

Place	Under 25				Under 20				20 to 25				25 to 30				Over 30				Over 25			
	P.	A.	L.	R.	P.	A.	L.	R.	P.	A.	L.	R.	P.	A.	L.	R.	P.	A.	L.	R.	P.	A.	L.	R.
Maritzburg	56·3	73·6	1·31	100	4·8	1·9	0·39	30	51·5	71·7	1·39	106	33·5	20·8	0·62	47	7·0	5·6	0·80	61	40·5	26·4	0·65	50
India	44·7	72·0	1·62	100	—	—	—	—	—	—	—	—	33·9	23·5	0·69	43	13·7	3·55	0·26	16	47·6	27·0	0·57	35
Metropolitan Asylums Board	19·9	41·0	2·30	100	10·3	23·9	2·32	101	9·6	17·1	1·78	77	—	—	—	—	—	—	—	—	15·7	21·9	1·39	60
Bermuda	57·9	47·8	0·81	100	7·8	—	—	—	50·1	47·8	0·95	107	291·	34·8	1·19	147	13·0	17·4	1·34	165	42·1	52·2	1·24	153

P. = Percentage of total population.
A. = Percentage of total admissions and deaths.
L. = Relative liability.
R. = Ratio of liability compared to that of age group under 25 years.

tions of different age and compositions. . . . To simplify the table in the column marked R, the ratios have been reduced to percentage of the liability, 'under 25' taken as a standard."

He further remarks that there is a possible difference in the case of the figures of the Metropolitan Asylums Board, between the age composition of the population from which the cases were drawn and the normal urban population. The probable error is in the admission rates for under 20 (*i.e.*, 15 to 20) and 20 to 25, as the young unmarried artisan living in lodgings is more likely to be sent to hospital than a patient of any other age, so that the percentages during these two periods are probably a little too high.

Comparing the statistics, it would appear that the incidence in Bermuda, as elsewhere, is least under 20 years of age, while no deaths occurred. From 20 to 25 the incidence in Bermuda is about the same as in Maritzburg, and the same is true of the mortality.

In the next quinquennial period the incidence of the disease falls in Bermuda as it does in Maritzburg, and also in India, but not nearly to the same extent. Over 30, the incidence in Bermuda again falls, being the same as in India, but twice as great as in Maritzburg. When it comes to mortality, however, a very marked change is noticeable, for in Bermuda the liability to death increases with increased age instead of diminishing, as in other places.

In the next Table (Table F) the average annual strength of each age group for the nine years for which statistics are available is shown, with the actual number of admissions and deaths, the percentages of both to the strength of each group; and for convenience the ratio of these percentages to that of 20 to 25 as a standard.

The mean of the figures for the nine years shows that out of a strength of 1,095, 17 cases of enteric occurred under 20 years of age without a death, or $1{\cdot}55 \pm 0{\cdot}65$ per cent. for admissions, about half the incidence of 20 to 25.

During the lustrum 25 to 30 years, the ratio of the percentage of admissions and deaths is 78 and 126 respectively, and over 30 years, 47 and 142 respectively. The probable errors are not very great, and the figures would appear to be in accordance with the fact.

Lieutenant-Colonel Simpson notices in the Maritzburg statistics that there was an unusual preponderance of cases in the 25 to 30 group, on account of an exceptionally high admission rate for the group during two epidemic periods, and adds: "That is, in the two epidemic periods the normal diminished liability, with increased age, was suspended, and it will be seen later that a similar unusual

TABLE F.—STRENGTHS, ADMISSIONS, AND DEATHS BY AGE GROUPS. BERMUDA, 1895 TO 1903.

Year	Under 20							20 to 25							25 to 30							Over 30						
		Cases			Mortality				Cases			Mortality				Cases			Mortality				Cases			Mortality		
	S.	Ad.	Per cent.	R.	D.	Per cent.	R.	S.	Ad.	Per cent.	R.	D.	Per cent.	R.	S.	Ad.	Per cent.	R.	D.	Per cent.	R.	S.	Ad.	Per cent.	R.	D.	Per cent.	R.
1895..	34	3	8·82	92	—	—	—	764	73	9·55	100	9	1·18	100	470	27	5·74	60	8	1·70	144	179	4	2·23	23	3	1·68	142
1896..	28	—	—	—	—	—	—	741	16	2·16	100	3	0·40	100	468	9	1·92	89	—	—	—	150	2	1·33	62	1	0·67	167
1897..	36	2	5·55	252	—	—	—	910	20	2·20	100	3	0·33	100	429	9	2·10	95	3	0·70	212	146	3	2·05	96	1	0·68	206
1898..	98	2	2·04	168	—	—	—	1,072	13	1·21	100	2	0·19	100	415	9	2·17	179	2	0·48	252	145	2	1·38	114	—	—	—
1899..	68	—	—	—	—	—	—	872	10	1·15	100	—	—	—	601	8	1·33	116	—	—	—	159	2	1·26	109	—	—	—
1900..	16	—	—	—	—	—	—	250	3	1·20	100	—	—	—	238	4	1·68	140	—	—	—	128	—	—	—	—	—	—
1901..	47	1	2·13	116	—	—	—	328	6	1·83	100	—	—	—	400	4	1·00	54	1	0·25	—	239	—	—	—	—	—	—
1902..	379	8	2·11	50	—	—	—	783	33	4·21	100	5	0·64	100	530	12	2·26	53	1	0·19	29	359	10	2·78	66	3	0·83	130
1903..	389	1	0·26	11	—	—	—	1,327	32	2·41	100	—	—	—	546	11	2·01	83	1	0·18	—	315	2	0·63	26	—	—	—
Mean	1,095	17	1·55 ±·65	53	—	—	—	7,047	206	2·92 ±·56	100	22	0·31 ±·08	100	4,097	93	2·27 ±·29	78	16	0·39 ±·11	126	1,820	25	1·37 ±·20	47	8	0·44 ±·10	142

S. = Average annual strength of age group.
Ad. = Number of admissions in each age group.
D. = Number of deaths in each age group.

Per cent. = Admissions or deaths per 100 of strength in each group.
R. = Rates of percentage to that of 20 to 25 as a standard.

incidence among men of longer service in the country also obtained at these periods."

Now in Bermuda, 1895 and 1902 were such abnormal years, and it is of interest to note that, taking the ages above 25, a similar abnormal suspension of diminished liability seems to occur. As regards the mortality no less than 14 out of the 24 deaths, above 25 years of age, occurred during these years.

These facts could be explained by a theory that during epidemics the "normal diminished liability with increased age was suspended," to quote Colonel Simpson again; and further, that during these years the normal fatality was also considerably exceeded in the older men.

Indian statistics cover such large numbers that an epidemic makes no particular effect upon them, there always being an epidemic of more or less severity somewhere. I have searched the Army Medical Department Reports with some care, but can find no statistics that throw any light upon this point whatever.

Surgeon-Captain Newland discusses the "Ages of the Enteric Cases," in his Report on the Quetta Outbreak of 1896 (Army Medical Department Report for 1897, Appendix VIII.). He gives the strength, number of cases in the various age groups, and the percentages the latter bear to the total, but unfortunately omits the percentages of the groups in the population and the ages of the fatal cases.

Major McCulloch, in his exhaustive report on enteric in India, published as Appendix III. to the Army Medical Department Report for 1900, discusses the age incidence for the whole of India, but not for isolated epidemics. It would be both interesting and instructive to ascertain whether the suggested theory is borne out by experience of other epidemics.

That the Bermuda statistics should show this increased liability to fatal cases among older men is the more remarkable, as the relative mortality is less in the age groups under 25, compared to both India and Maritzburg. Of course, it may turn out to be purely accidental, due to the comparatively small numbers.

B.—The Influence of Service.

The statistics are available from 1895, and are presented in Table G, which is constructed on the model of the last. As will be noticed, the epidemics of 1895 and 1902 cause an undue incidence in the men of longer residence (usually also the men of older age).

TABLE G.—STRENGTHS, ADMISSIONS, AND DEATHS BY PERIODS OF SERVICE IN BERMUDA, 1895 TO 1903.

	Under 1 year							From 1 to 2 years							From 2 to 3 years							Over 3 years						
		Cases			Mortality				Cases			Mortality				Cases			Mortality				Cases			Mortality		
	S.	Ad.	Per cent.	R.	D.	Per cent.	R.	S.	Ad.	Per cent.	R.	D.	Per cent.	R.	S.	Ad.	Per cent.	R.	D.	Per cent.	R.	S.	Ad.	Per cent.	R.	D.	Per cent.	R.
1895..	528	47	8·90	100	11	2·08	100	394	27	6·85	77	4	1·01	49	457	32	7·00	79	5	1·10	48	68	1	1·47	16	—	—	—
1896..	831	13	1·56	100	2	0·24	100	370	11	2·97	190	1	0·27	112	122	2	1·64	105	—	—	—	64	1	1·50	96	1	1·50	625
1897..	520	13	2·50	100	2	0·38	100	692	13	1·88	75	4	0·58	153	232	3	1·29	52	—	—	—	77	5	6·49	260	1	1·30	342
1898..	1,179	18	1·53	100	3	0·25	100	331	8	2·42	159	1	0·30	120	111	—	—	—	—	—	—	109	—	—	—	—	—	—
1899..	317	5	1·58	100	—	—	—	1,084	10	0·92	58	—	—	—	190	3	1·58	100	—	—	—	109	2	1·83	116	—	—	—
1900..	57	1	1·75	100	—	—	—	159	1	0·63	36	—	—	—	290	5	1·72	98	—	—	—	126	—	—	—	—	—	—
1901..	494	8	1·62	100	1	0·20	100	49	—	—	—	—	—	—	157	—	—	—	—	—	—	314	3	0·95	59	—	—	—
1902..	1,649	55	3·33	100	7	0·42	100	268	3	1·12	34	—	—	—	30	—	—	—	—	—	—	104	5	4·81	144	2	1·92	457
1903..	1,457	25	1·72	100	1	0·07	100	943	16	1·69	98	—	—	—	129	3	2·32	135	—	—	—	48	2	4·17	243	—	—	—
Mean	7,032	185	2·63 ± ·50	100	27	0·38 ± ·13	100	4,290	89	2·07 ± ·41	78	10	0·23 ± ·07	61	1,718	48	2·79 ± ·51	106	5	0·29 ± ·08	79	1,019	19	1·86 ± ·49	70	4	0·39 ± ·17	103

S. = Average annual strength by Service in Command.
Ad. = Number of admissions ,, ,, ,,
D. = Number of deaths ,, ,, ,,

Per cent. = Admissions or deaths per 100 of strength by Service in Command.
R. = Rates of percentage to that of under 1 year as a standard.

This is similar to the same state of things noticed during the epidemic years in Maritzburg. The whole of the five deaths in the 2 to 3 year group occurred during the great epidemic of 1895; and two out of the four deaths in the over 3 years group occurred in the lesser epidemic of 1902.

The strengths given are the actual annual averages. The influence of prior service, whether in England or Malta, has already been discussed.

The influence of the branch of the Service to which the patients belonged is not discussed, as no cavalry or other mounted arms serve in Bermuda.

Conclusion.

The following conclusions would seem to be warranted.

(1) In Bermuda the cases usually diagnosed simple continued fever are in the large majority of cases mild enteric fever.

(2) During the decennial period 1884 to 1893 the incidence of enteric fever amongst the troops was greatest in the autumn, and was probably chiefly due to contaminated drinking water. In more recent years, however, the period of greatest incidence is in the summer, being chiefly due to flies and contaminated dust.

(3) That the sanitary conditions at Prospect are not yet perfect, while those at Boaz and Warwick Camp also leave much to be desired.

(4) That at the present time the troops stationed at St. George's and at Prospect suffer less from enteric than those at Boaz and at Warwick Camp.

(5) That this is due not only to the sanitary defects at those stations, but also to insufficient barrack accommodation; while as regards Boaz the surrounding country is highly insanitary.

(6) That the Bermuda statistics show an increased liability to enteric fever among men of an older age than is usually disclosed.

(7) That this unusual incidence may be a feature of epidemics.

(8) That a similar excess of deaths occurred among older men, and may be due to the same cause.

It has been suggested that it would be a very valuable experiment to select some station where enteric fever is endemic, and try the effect of carrying out every possible sanitary precaution, regardless of expense. If such a cause were decided upon, I doubt whether a more suitable station than Bermuda could be selected.

THE TREATMENT OF GONORRHŒA.

By Major C. E. POLLOCK.
Royal Army Medical Corps.

While much has been written on the treatment of syphilis, gonorrhœa seems to have attracted little attention, yet it is an important cause of non-efficiency among our soldiers. In the home army, from 1886 to 1895 (the latest figures I have by me), the average number constantly sick from this cause was 601, *i.e.*, or the best part of a home battalion, which gives us for the ten years a loss of nearly 2,200,000 days of service. I believe that this loss may be considerably reduced by employing modern methods of treatment. This advance in treatment has been rendered possible by the introduction of more efficient drugs and by the careful investigation of the pathology of the disease by Continental workers, more especially Finger. As this foreign literature is, perhaps, not easily accessible to most R.A.M.C. officers, I propose giving a brief *résumé* of the more important points which should be borne in mind when dealing with this disease. It is always difficult to convey one's meaning clearly in writing, and my description of the modern treatment may make it appear complicated and troublesome to carry out. I can only say that the work is not really so much as it appears to be, while, if cases are seen when actually undergoing treatment, the important points will be readily grasped and, with a little experience, difficulties will disappear. I will now go on to the various points which, up to the present, do not seem to have received the attention they merit in English text-books.

Anatomy.—For our present purpose the urethra consists of two portions, viz., all in front of the constrictor urethra, which is spoken of as the anterior urethra, while that beyond this muscle is called the posterior urethra, and is continuous with the bladder when full. Along the upper surface of the anterior urethra are Littre's glands, while opening into the posterior are Cowper's glands, the ejaculatory and prostatic ducts.

Pathology.—Finger, as the result of his work on this subject, says that gonococci, on gaining entrance to the urethra, form colonies on the mucous membrane. If not actively interfered with (*i.e.*, if the expectant treatment be adopted), these colonies rapidly multiply, fresh centres are formed, and the whole mucous membrane becomes involved; in 85 per cent. of cases the posterior urethra is reached at

the end of a week to ten days, at the same time the gonococcus invades Littre's glands and in the posterior urethra the ducts opening into it. When this has been allowed to occur, the gonococci are to a great extent protected against any remedy used to destroy them, as it will be readily understood how difficult it is to make any solution penetrate into a duct, and, indeed, infection of the prostatic ducts is one of the most common causes of a persistent chronic gonorrhœa. Simultaneously, the irritating toxins produced by the organism set up sharp inflammation of the mucous membrane, with a serous exudation which soon becomes purulent. This exudation, forcing its way out between the epithelial cells, opens up a path along which the gonococcus travels as far as the subepithelial layer of connective tissue. Alcohol increases the œdema, and so facilitates the passage of the gonococcus, hence its well-known deleterious effect.

Diagnosis.—A muco-purulent urethral discharge may occasionally be due to organisms other than the gonococcus, hence, if time permits, it is advisable to stain a smear, and in doubtful cases this should always be done. The essential thing, however, is to know whether the whole urethra is attacked or the anterior portion only, as in the former cases urethral injections with the small syringe are merely a waste of time and drugs, while in the latter condition balsams are of little or no use. To determine this, Thompson's two-glass test is employed as follows: Give the man two glasses—ordinary tumblers do well—and tell him to pass four to five ounces of urine into the first glass and to fill the second. The first glass contains the washing of the anterior portion, while the second is filled with the urine from the bladder, and shows any purulent secretion or threads coming from the posterior urethra. The first glass, therefore, shows the condition of the anterior urethra, the second that of the posterior. Remembering this, hold the glasses to the light and examine them by looking through. Thick, turbid urine means an acute urethritis; cloudy urine, with large solid threads, shows a subacute urethritis; while clear urine, with thinner threads, denotes a chronic condition. Mucoid transparent threads sometimes persist for long periods; these usually mean that a catarrhal condition of the glands exists, either as the result of severe inflammation or of too prolonged treatment. If any doubt exists in the observer's mind, let him fish one of the threads out and, after staining, examine it microscopically. If due to chronic gonorrhœa, numerous pus-cells or gonococci will be found, while in non-gonorrhœal catarrh epithelial cells and mucoid material make up the bulk of the thread. Phosphaturia will cause

a pale, cloudy urine, which at once becomes clear on the addition of a few drops of acetic acid.

Treatment.—Having determined how much of the urethra is affected, and the stage of the disease, we are enabled to adopt suitable treatment. A word or two as to drugs may be useful. The most effective remedy we at present possess is undoubtedly nitrate of silver. This has two drawbacks: it precipitates in the presence of sodium chloride, losing much of its therapeutic value, and it causes considerable irritation. The newer silver preparations, *e.g.*, protargol, albargin, argonin, argentamin, argyral, largin, ictbargan, &c., are compounds of silver nitrate and an organic substance. They do not precipitate with chlorides, are soluble in water, cause much less irritation than nitrate of silver, and rapidly destroy the gonococcus. The great objection to their use at present is their high cost, and they should not, therefore, be ordered as a routine treatment in every case, *e.g.*, injections of protargol with the small syringe in cases of posterior urethritis, for which condition a cheaper drug might be equally well employed with the same result. Permanganate of potassium is useful for irrigating acute cases, as it has a slightly astringent effect and does not irritate; its curative value is, however, very small, and benefit must be looked for rather from the mechanical action of flushing than from its bactericidal power. Sulphate of lime may occasionally be found useful as an astringent in chronic gleety cases with much mucoid discharge; its value in the ordinary case of gonorrhœa is, however, very small. One of the most important factors in the successful treatment of gonorrhœa is to begin as early as possible before the gonococci have penetrated to the subepithelial layer and invaded the ducts. Experiments have shown that 4 per cent. protargol, if injected within twelve hours of infection, will entirely prevent the development of the disease. As regards methods of treatment, a considerable variety are possible; each authority, of course, has his own, which he claims is the best. I would suggest that the following be tried, and that the one which gives the best results be adopted or improved upon to suit the officer's fancy.

Methods of Treatment.—This may be roughly classified as (1) small syringe, (2) large syringe, (3) irrigation, (4) mechanical.

(1) *Small Syringe Method.*—For *anterior urethritis* Neisser and Finger both favour this method, using one of the newer silver salts. They, however, strongly insist on the following points being observed: (*a*) The injection must be of sufficient volume to gently distend the mucous membrane, and thus allow the solution to get

into contact with every portion of its surface; about one-third of an ounce is the quantity usually required. (*b*) The injection must be retained for some time; Finger directs that *each* injection be held for two minutes on the first day, three on the second, increasing the time daily up to fifteen minutes. (*c*) At least three injections should be given daily, at intervals of eight hours, say at 6 a.m., 2 p.m., and 10 p.m. (*d*) The strength of the solution should be as much as the patient can tolerate. When using protargol have two solutions, one containing one grain to the ounce, and the second eight grains to the ounce. Begin with the first; when this ceases to cause any discomfort, add gradually increasing quantities of the second till it is being used undiluted.

(2) *The Large Syringe Method.*—This method may be used for either anterior or posterior urethritis. It makes more work for the medical officer and soils his hands, but gives good results. A four or six-ounce metal syringe, to which a blunt rubber nozzle is attached, is filled with the solution selected. With his left hand the surgeon now seizes the man's glans, while with the right he presses the nozzle of the syringe into the meatus. With a short, sharp push the urethra is fully distended, and the fluid immediately allowed to escape by withdrawing the syringe. This is repeated till the syringe is empty. Should it be desirable to inject the bladder, first wash out the anterior urethra, then refill the syringe, and maintain steady pressure till the sphincter yields, allowing the fluid to run into the bladder. After a few minutes the man should be told to empty his bladder into a glass vessel, and show this to the surgeon.

(3) *Irrigation Method.*—This is very suitable to military hospitals, as when the anterior urethra alone is affected the soldier can irrigate himself, and, if supervised, a dozen men can do so at the same time. Apparatus required: An irrigator can, or better, hanging glass vessel, with five feet of rubber tubing, a push stop-cock, and a Maiocchi's double-channel glass nozzle. The irrigator should be five feet above the man's penis, when the anterior urethra is being irrigated; reduced pressure may be used by only opening the stop-cock half-way, while if it is desirable to fill the bladder, the tap should be fully opened. In acute cases the best and cheapest solution to use is potassium permanganate, beginning with $1\frac{1}{2}$ grains to the pint, and never exceeding $2\frac{1}{2}$ grains to the pint. The solution should be about body temperature, and the irrigation employed each morning, or, if no discomfort is experienced by the patient, a second irrigation may be given in the evening. I am inclined to think that, in anterior urethritis, one irrigation in the morning, followed by an injection of

protargol in the evening, will yield the best results. To apply this treatment the surgeon, wearing a mackintosh apron, should be seated opposite to the patient, and the latter's penis pulled through a hole in a piece of waterproof reaching down to a slop bucket. Turn on the tap, and wash the glans thoroughly, then, keeping the tap open, slowly apply the nozzle to the meatus, and, increasing the pressure by opening the tap a little more, allow a pint of fluid to run through. The fluid will run up to the sphincter, but not beyond as long as the outflow tube is left open ; if it is desired to fill the bladder, close the escape tube by pressing the finger on it, and tell the patient to try to pass his water ; this releases the sphincter and allows the fluid to flow into the bladder. When the man feels that his bladder is full, shut off the stream, and let him empty his bladder into a glass vessel. Note how much he can hold comfortably, and whether the solution shows much change as the result of having been in his bladder. The irrigation (as also the large syringe injection) thoroughly washes out the urethra, carrying away all gonococci lying on the surface and in the folds of the mucous membrane. It also has the effect of massaging the epithelium, which subsequently sets up a certain amount of œdema and serous exudation in which the deeper-lying gonococci are carried to the surface. Occasionally marked œdema of the penis may occur; this will subside if left alone. Irrigation may be employed at any stage of the disease, and is not contraindicated by epididymitis. When the subacute stage is reached, it is better to use albargin, beginning with $2\frac{1}{2}$ grains to the pint, and increasing to 5 grains to the pint. Nitrate of silver, 8 grains to the pint, is also useful in obstinate cases, but it stains the fingers badly. The methods already described are useful in acute and subacute cases. In chronic cases, however, when the gonococcus has penetrated to the subepithelial tissue lining the ducts of the various glands, something more is required. For the anterior urethra the easiest procedure is to pass a large bougie. This, by stretching the mucous membrane, compresses Littre's glands, and expels their contents. An injection of protargol, if given at once, will destroy the gonococci lying in these expelled casts. The size of the bougie is, however, limited by that of the meatus, and it is not always possible to use a bougie of sufficiently large calibre to properly stretch the mucous membrane. To obviate this various screw-bladed dilators have been introduced. These can be passed through a relatively small meatus, and when in the urethra opened out to any required size. The best one is Kollmann's irrigating dilator, as it permits of the urethra being thoroughly washed out, while the mucous membrane is kept on the stretch.

When using any instruments in the urethra, strict asepsis must, of course, be maintained, as otherwise a second pyogenic infection may be set up, and a spurious gonorrhœa ensue. A chronic posterior urethritis is almost due to infection of the prostatic ducts. Mechanical dilators are of little use in this condition. The best procedure is to fill the bladder with albargin (5 grains to the pint), then insert a forefinger, protected by a rubber finger-stall, into the rectum and thoroughly massage the prostate for a couple of minutes. The pus cells and gonococci lying in the ducts are thus expelled into the albargin solution, which immediately destroys all gonococci. It is possible that a small quantity of the albargin solution may even work its way into the ducts; at any rate, experience shows that if this procedure be carried out on several successive mornings, it is often impossible to find any gonococci in the expressed prostatic secretion, which, as a general rule, we may look on as a proof of cure.

Recapitulation of Main Points when Treating Gonorrhœa.

(1) Before beginning any treatment always apply Thompson's two-glass test.

(2) If the anterior urethra is attacked, begin local treatment at once, either injections of protargol or permanganate irrigations, but do not force any fluid beyond the sphincter.

(3) If both the anterior and posterior urethra are affected, employ irrigations or the large syringe injections, filling the bladder with the solution selected. At the same time give balsams, turpentine, salicylate of soda, urotropin, or other bladder antiseptic.

(4) See the man's urine daily, and order treatment according to the condition of the urethra as shown by the state of the urine in the two-glass test.

When is a Gonorrhœa Cured?—This is not always an easy question to answer. The time-honoured test of "squeezing the pipe" to show the absence of visible discharge is absolutely worthless. If any one doubts this statement, let him apply Thompson's two-glass test in a series of cases which show no visible discharge, and note in how many threads or even turbid urine is still present. The following is the plan adopted in some German hospitals, and if properly carried out very few uncured cases will be discharged from hospital. The first urine passed in the morning is examined. If this is clear and free from threads on three successive mornings, give the man a full diet, including beer and as much fatigue work as possible; if the

urine still remains clear, the man may safely be discharged cured. In many cases, however, threads will persist for some time. These must be fished out, stained and examined microscopically. When pus cells are abundant, with or without gonococci, further treatment is indicated, as there is some focus left which will start the disease. The importance of effecting a complete cure in these chronic cases cannot be over-estimated. When an attack of gonorrhœa has lasted for some time the host appears to become immune to the particular strain, and cases have been published in which the gonococcus has existed without showing any appreciable evidence of its presence for years. But if a case of this kind contracts marriage, the gonococcus on being deposited on the mucous membrane of another person is capable of starting the disease afresh, with unpleasant or serious consequences. It is now recognised that the majority of cases in which women suffer from obscure pelvic troubles are due to gonococcal infection, and this may be acquired from a husband who is totally unaware of his condition. Gonorrhœa is a common cause of sterility in women, hence, from a public health point of view, we should do our utmost to cure it. Efficient treatment will cause a certain amount of extra work for the medical officer, and a certain amount of consideration should be shown him, *i.e.*, he should, if possible, be left undisturbed in this work, as the success or otherwise of the treatment depends, to a large extent, on mutual understanding between patient and surgeon. I am convinced, however, that the results will well repay the State.

Clinical and other Notes.

A CASE OF CHRONIC ABDOMINAL DISORDER.

By Major G. CREE.
Royal Army Medical Corps.

The following case illustrates the fact that frequently in chronic abdominal disorders, accompanied by a neurotic condition, an operation, though in itself inconclusive, frequently relieves all symptoms. It also presents other points of interest.

Mrs. D., aged 37, married fourteen years, no family and highly neurotic, was sent to hospital by the Medical Officer of the Royal Marine Light Infantry with the following history: Soon after marriage she suffered, after not having seen her periods for two months and supposing herself to be pregnant, from an attack of violent pain in abdomen with bleeding from the uterus. From that time to this she had always suffered from considerable pain during the menstrual period and also between times. For the last three months all her symptoms had become very much aggravated, the pain very acute and constant, with the menstrual period most irregular. This suffering had produced a very considerable degree of emaciation, and there had been obstinate constipation, the temperature somewhat unsteady, but nothing that indicated suppuration. Two days after admission, on June 10th, 1903, a thorough examination under chloroform was made, when the following condition of affairs was found.

Palpation through the abdominal walls revealed nothing, beyond the fundus of the uterus occupying a somewhat higher position than natural. Vaginal examination showed that canal to be shortened and the posterior wall very firm and resistant. The uterus was found to be somewhat thrust forward, but not fixed; the os uteri was in normal relative position with no flexion or version, a sound passing easily the whole length of the organ. *Per rectum* there was found, apparently occupying the whole of Douglas's pouch, a large rounded swelling about the size of a large orange, which almost obliterated the lumen of the gut. It was quite smooth, the feel elastic but not fluctuating, and apparently firmly fixed. The mucous membrane over it was smooth, not infiltrated or thickened, and no large lymphatic glands could be found.

A few days later a second examination was made, and as no change in the condition of affairs was found, it was decided to operate as soon as possible. On June 24th, 1903, the abdomen was opened by a median incision below the umbilicus and the following conditions found: The uterus somewhat enlarged and smooth. The ovaries, Fallopian tubes

and broad ligaments were firmly tied to the sides and bottom of Douglas's pouch behind, and also to the back of the bladder and abdominal wall in front, by extensive old adhesions. No tumour of any description was found, and the ovaries were small and healthy, so, taking into consideration the extent and character of the adhesions and the risk there would be of injuring the rectum, bladder and ureters by any attempt to break them down, it was decided to do nothing further. The abdomen was closed in two layers, and the wound dressed with cyanide gauze.

The after progress of the case was quite uneventful and apyretic. The wound was dressed on the sixth day and had healed by first intention, and on the fourteenth day the patient was allowed up and to partake of her ordinary diet. Three weeks after the operation, the patient being quite convalescent and all her previous trouble having entirely disappeared, she was again examined, when it was found that the "swelling" in Douglas's pouch had completely disappeared. She left hospital on July 25th, 1903, one month after the operation, apparently quite relieved of all her troubles.

A CASE OF OVARIOTOMY PERFORMED AT THE MILITARY FAMILIES HOSPITAL, DEVONPORT.

By Major G. CREE.
Royal Army Medical Corps.

Mrs. D., aged 29, was sent into this hospital from Bodmin on March 12th, 1904, suffering from an ovarian tumour.

Operation.—On March 17th the abdomen was opened in the usual way under chloroform, and the tumour found to be an unilocular cyst of the left ovary. Being too large to deliver *en masse* through the abdominal wound, it was punctured and gradually drawn out. There were two moderate adhesions to omentum, which were ligatured and divided. The pedicle was of moderate length and thickness, and was ligatured with the usual precautions. The cyst held about one gallon of fluid. The right ovary being found normal, the wound was closed in three layers, silk being used in each instance.

Progress.—There was very little shock after the operation, and practically no vomiting, the temperature the same evening being only 98·4° F. The patient expressed herself as being very comfortable, there being but little pain. On the following day (18th) the morning temperature was 98·8° F., and the evening temperature 99·8° F.; on the next day (19th) the morning temperature was 100·5° F., and the evening temperature 102·8° F. This sudden and acute rise of temperature was in itself somewhat alarming, but the absence of vomiting, distension of abdomen and pain prohibited the idea of septic absorption. The follow-

ing morning (20th) the outer layers of the dressings were removed, and the wound was found quite dry. There was found to be, however, considerable tenderness over the right ovary, and she also complained of pain in the right parotid region. From this day forward there was, in spite of a most irregular temperature, uninterrupted convalescence. All the sutures in the skin were removed on the 25th, when the wound was found quite firmly healed. She was eating her ordinary food and allowed up on the twenty-first day after the operation, and left for Bodmin on April 21st.

The irregular, and at first somewhat alarming temperature in this case, I put down entirely to "hysteria." She was of an extremely neurotic temperament and very excitable. The pain in the ovary and in the parotid region was only transient, though it was at first feared there would be an exhibition of the classical abdominal parotitis.

REPORT ON A CASE OF CHRONIC HYDROCELE TREATED BY OPERATION, "OPEN METHOD."

By Major J. H. BRANNIGAN.
Royal Army Medical Corps.

Patient reported sick at the Station Hospital, Sheffield, on February 2nd, 1905. He stated that he first noticed pain and swelling in right side of scrotum in December, 1903, whilst on furlough in London. In December, 1904, patient was again on furlough in London, when scrotum became very much enlarged and painful; he attended a civil medical practitioner, who on three successive occasions tapped the hydrocele, giving temporary relief. On returning to Sheffield, the fluid having re-accumulated, he was admitted to hospital. I recommended the "open method" of operation for a cure, to which he consented on February 7th. The patient having been chloroformed, I cut down on the hydrocele by an incision through the upper part of the scrotum, and, separating the tunica vaginalis from the superjacent structures, I then opened the cavity and snipped away with scissors close to the testicle the parietal portion of the tunica; several vessels required ligaturing; a small drainage tube was inserted, the wound being closed in the usual manner.

The wound healed by first intention, with the exception of that portion where the drainage tube was inserted.

Patient left hospital on February 28th, 1905, for duty. Had he not also been suffering from an enlarged testicle, he would have been discharged to duty on the 16th.

Thorough aseptic surgery was observed throughout.

THE EMPLOYMENT OF NON-COMMISSIONED OFFICERS AS SANITARY INSPECTORS.

By Captain ROBERT J. BLACKHAM.
Royal Army Medical Corps.

In a recent issue of this Journal a contributor suggested the employment of non-commissioned officers of the Corps as anæsthetists in military hospitals, a proposal which I have heard subjected to severe criticism by members of the staff of London hospitals, and officers of our own Corps.

Without wishing to appear controversial, I would point out that any movement which would appear to depreciate the value of the services of the trained anæsthetist is contrary to the spirit of medical teaching of the present day.

Instead of finding Sisters, or other officials corresponding in rank to our non-commissioned officers, employed as anæsthetists in large civil hospitals, we find highly-qualified physicians eagerly competing for these appointments, while at the Post-Graduate College of the West London Hospital I have noticed that the sessional courses of "Instruction in the Administration of Anæsthetics" are particularly popular, especially with Service men attending the College.

Moreover, the duties of an anæsthetist are considered so important by our own Headquarter Staff, that officers, usually of field rank, have recently been appointed to the post of anæsthetist in all large hospitals and are required to keep a record of each administration on a special form.

We must not, therefore, in the Service, attempt to go against the tide of medical opinion outside the Army, but should, I think, adapt our hospital system, as far as circumstances will allow, to good civilian models; but if we wish to extend the sphere of usefulness of our non-commissioned ranks we have not far to seek for suitable work without trenching on purely medical grounds.

By the King's Regulations and Regulations for the Army Medical Services, Medical Officers in charge of effective troops in quarters are required to visit every portion of the barracks under their charge at least once a week, "to examine as to their general condition and cleanliness." They are further required to keep notes in their Sanitary Diaries of all such examinations and the representations made verbally or in writing to the Officer Commanding, together with the results of such representations (Regulations, Army Medical Services, para. 110).

This duty is usually conscientiously performed, but if we look over the Sanitary Diaries of officers in charge of units, we find that they resemble the diary of an Inspector of Nuisances appointed under the Public Health Act of 1875 rather than the health notes on the community under his supervision, kept under the provisions of the same Act of

Parliament, by the inspector's superior, the Medical Officer of Health of the Urban or Rural Sanitary District.

If we look up the Sanitary Diary of any Corps, we find, for instance, such notes as the following: "Yard gullies dirty"; "Water-closets not clean, and insufficiently supplied with paper"; "Bath-rooms not in good order"; "The dangers to health, due to spitting about in living rooms is apparently not appreciated by the men of 'A' Company"; "The cook-houses are not supplied with sufficient cleaning material, and dirty rags are in use as dish-cloths."

These sanitary points are not matters which require a special training in medicine and surgery for their appreciation, and could be noted and reported to the Officer in Sanitary charge by any non-commissioned officer specially trained as a sanitary inspector; and I submit, with all deference, that as similar *routine* inspections are not made by a civilian Medical Officer of Health, there does not seem any reason why the duty should be *invariably* performed by an officer of the Royal Army Medical Corps, who is, in this relation, simply a Military Medical Officer of Health.

One of the points most impressed on me during my recent course of study at the Royal Army Medical College was the necessity for a sanitary cadre in our Corps, and I think in establishing a system of sanitary inspectors working under one officer in each district, or large garrison, we should be making an important step in this direction, and at the same time bringing our sanitary work in the Service more into line with civilian methods.

Very little expense would be incurred, as I would propose to carefully select tactful non-commissioned officers, not under the rank of Staff-Sergeant, and send them to the Royal Army Medical College for a course of instruction in their duties, making them pass an examination similar to that held by the Sanitary Institute at the end of their course. It would not be necessary to give them special rates of pay, as Staff-Sergeants would gladly seek these appointments with a view to getting similar posts in civil life on retirement: the Local Government Board would no doubt accept our Corps certificate of sanitary inspector as it has already accepted our Certificate of Compounder as a qualification for appointments under the Board. The only objection to this scheme is that our sanitary inspectors might be brought into frictional contact with regimental authorities; but I think, if the inspectors only reported direct to their own officers, and were tactful in the initial stages of the working of the system, this need not occur; indeed I think, on the whole, Commanding Officers would be glad to hand over the whole of the sanitary care of barracks to our rank and file, instead of having these duties inefficiently performed by fighting men, who would be better employed on drills and manœuvres.

The proposal that our men should perform such duties is not really so novel as it seems, as we have an analogy in the Army Ordnance

Corps. Instead of the old-fashioned Regimental Armourer-Sergeant a non-commissioned officer of the Army Ordnance Corps is now attached to every infantry battalion; and if it is considered essential that a man of a specially trained corps is necessary for looking after the elaborate modern rifle, instead of the old Regimental Sergeant who had the care of the old "Brown Bess," it is surely equally important that the infinitely more complicated sanitary system and appliances of the modern barracks should be looked after by a scientific corps, instead of by the "bad drills and cripples" of the battalion who were good enough for the privies and middens of the insanitary past.

THE SPREAD OF ENTERIC BY LATRINE INFECTION.

By Colonel R. H. QUILL.

Royal Army Medical Corps.

I have read with much interest and profit in the January number of our Journal the article by Captain B. Burke, on the spread of enteric fever by latrine infection. For many years I have held the opinion that in India the latrines are a highly probable factor in the diffusion of enteric fever, a factor too often overlooked when investigating outbreaks of that fever. The pans used in India being of coarse ill-glazed earthenware, become easily fouled by organic matter derived from the excreta and urine. The sweepers in charge of the latrines are supposed to keep the pans clean, and they do so, after a fashion; but a thorough cleansing, owing to the roughness of the surface of the pans, is not to be expected from the barrack sweeper. The usual condition, then, of the latrine pans is well suited for a continuance of the saprophytic existence of any *Bacillus typhosus* which may find a place in them. That being granted, it is easy to understand how latrine pans so infected may serve as foci for the propagation of enteric fever among those using the latrines. It was on that assumption that I, some dozen years back, during a period of enteric fever prevalence, advocated the substitution of white enamelled iron pans for the rough earthenware ones in general use. Expense standing in the way of that proposal, I adopted the following plan for the purification of the earthenware utensils. I had *two sets of pans* issued to each latrine, so that a change of pans might be made on alternate weeks, and directed that the set of pans not in use—"off duty," so to speak—should, after preliminary cleansing, be filled with a 1 in 500 solution of perchloride of mercury, and placed under cover during their week of rest. I had much reason to be satisfied with the success which followed that practice. Writing from memory, all anxiety as to the prevalence of enteric cases soon ceased.

The purification of the pans after the manner I have indicated must, of course, go hand in hand with thorough cleansing of the latrine seats, a detail which Captain Burke justly dwells upon as a highly important prophylactic measure.

I should like to close the foregoing brief remarks on the important subject of enteric fever prophylaxis with a word or two as to the *rôle* of flies as carriers of infection. Indian kitchens at all times, but especially during the preparation of food, are infested with flies. It is well-nigh impossible to keep the flies out of the kitchens, equally impossible to prevent them alighting upon most of the articles of food; and when in this connection we remember that in Indian barracks the latrines are, as a rule, close by the kitchens, it is obvious how easily the soldier's food can be infected by the ubiquitous fly.

In connection with this subject I well remember an experience in Poona which will bear relating. Enteric fever, at the time I speak of, was very prevalent at that station, and a close investigation was being made in relation to the cause of the outbreak. Among other matters it was considered advisable to make an inspection of the place where the sewage of the native city of Poona was deposited. This place was some two miles from the city, and about an equal distance from the barracks. When some half a mile from the odoriferous spot we were in search of a "booming sound" was heard, the cause of which was a mystery. We continued our journey; the "booming sound" steadily increased in intensity, and explained itself on the sewage ground being reached. There we found three large tanks, one full, the others partly full, of putrescent filth, giving out an overpowering stench; on the surface of these filth tanks was an incredible swarm of flies, all busily engaged in sucking in the foul, green corruption. The buzzing of these flies was the cause of the "booming sound" which had so puzzled us when first heard over half a mile distant. The putrid contents of the tanks was eagerly bought by natives for agricultural purposes—a suggestive subject. But further, what of the poison-laden flies? Did they migrate? If so, where to, and with what result?

SPECIFICATION OF STILL.

By Major C. H. MELVILLE.

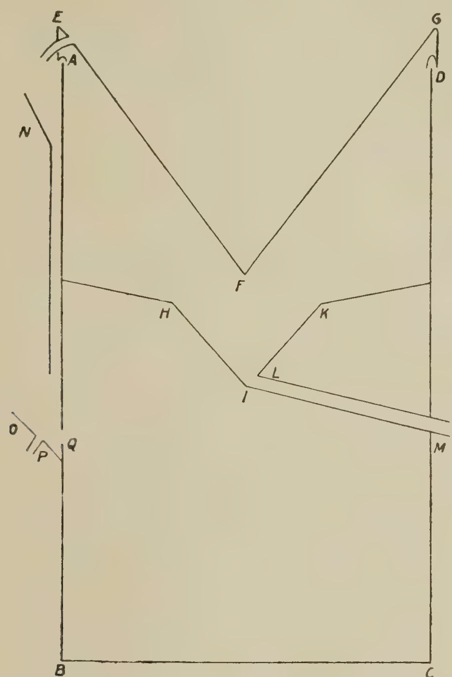
Royal Army Medical Corps.

The accompanying description and plan of a convenient form of still may be found useful for officers working where good distilled water is not procurable, and no more orthodox pattern is available. It is simple of construction and, in my experience, extremely efficient in action.

A, B, C, D, is a cylindrical boiler made of block tin, $18\frac{1}{2}$ inches in height, and $11\frac{1}{4}$ inches in diameter. The lid, E, F, G, of this tin is conical in shape, the depth of cone being $6\frac{1}{2}$ inches. The rim of this cone is bent over and slotted to fit tightly on to the cylinder.

Inside the cylinder is fixed a smaller cone, H, I, K, which is supported by wire stays from the sides of the tin. The diameter of this cone is about 5 inches, and its depth about 2 inches. The apex of this cone is

$8\frac{1}{2}$ inches from the bottom of the cylinder, and from it a pipe, L, M, runs to discharge outside the still. At one point, E, on the lid, E, F, G, there is a small tube running through the cone and its bent-over rim, and discharging into a small funnel, N. From this funnel a vertical pipe runs down to another small funnel, O, which opens both outwards at P, and inwards to the interior of the cylinder at Q.



The still is worked as follows: It is filled with water up to the level of the opening P, and placed on a "Primus" stove; as soon as the water begins to steam, cold water is allowed to run continuously into the cone shaped lid. The steam condenses on the lower surface of this cone and falls into the lower fixed cone (H, I, K,) from whence it runs by the pipe L, M, and is received in a bottle. Meanwhile, the cone-shaped lid having become full of water, the overflow escapes through the pipe at E, into the funnel N, and passes thence into the funnel O. If the level of the water in the cylinder has fallen below the level of the hole P, the overflow from the cone E, F, G, will pass into the interior of the cylinder until that level is reached, after which, as long as water is allowed to trickle into the upper cone, the level of the water in the still cannot possibly fall below the level P. If the supply, therefore, be constant, or from a cistern of considerable size, there is no likelihood of the still boiling dry in an ordinary day's work.

I find this still most convenient. It gives distilled water of excellent quality, ammonia free, at the rate of 1 litre in eighty minutes, or a gallon in about six hours. It needs no supervision once it is filled, the lamp lighted, and the water turned on. Its cost, made in the bazaar at Coonoor, was 5 rupees 12 annas. In making, the only points to be attended to are: that the point I must be above the opening P, and the opening P at a higher level, say a couple of inches higher, than Q. The opening P should be slightly larger, if anything, than the tube discharging at E into the funnel N, so that the funnel O may not overflow; but this would be a matter of small importance, even if it occurred, which is unlikely.

The dimensions given are those of the still in use in my laboratory, and the attached plan is drawn to scale.

ANNUAL REPORT ON THE WORKING OF THE ARMY VACCINE INSTITUTE, FOR THE YEAR ENDING MARCH 31ST, 1905.

During the year sufficient vaccine for 115,479 persons has been issued:—

Army	Home Stations	74,710
	Foreign	4,220
Royal Navy ..	.. ..	36,549

The total quantity supplied since the opening of the Institute is 1,206,061.

RESULTS OF VACCINATION.
As shown by Returns received during the Year.

—	Primary						Re-vaccination.			Totals
	Infants			Others						
	P.	M.	F.	P.	M.	F.	P.	M.	F.	
Army, Home .	2,588	70	56	1,223	96	14	37,387	16,527	4,155[1]	62,116
Army, Foreign	256	22	28	53	1	3	326	190	240	1,119
Royal Navy ..	3	—	—	39	—	—	949	765	519	2,275
Totals ..	2,847	92	84	1,315	97	17	38,662	17,482	4,914	65,510

[1] Of these, 3,689 are noted on the returns as showing good marks of previous vaccination.

PERCENTAGE OF SUCCESSFUL VACCINATIONS.

	Army		Royal Navy
	Home	Foreign	
Primary, Infants	97·94	90·85	100·0
Primary, Others	98·95	94·74	100·0
Re-vaccination	92·85	68·26	76·76

Philosophy, Travel, &c.

THE ORIGIN OF LIFE.

V.

By Lieutenant-Colonel BRUCE SKINNER.
Royal Army Medical Corps.

(*Continued from page* 673.)

In order to assist the reader in following the lines of distribution of mammals a chart of the distribution of land and sea at the end of the Eocene period is attached. From this will be apparent the obstacles to the spread of species arising during that period, and the reason why lands distant from the North are behind the times in the type of life-forms of which they are the present abode.

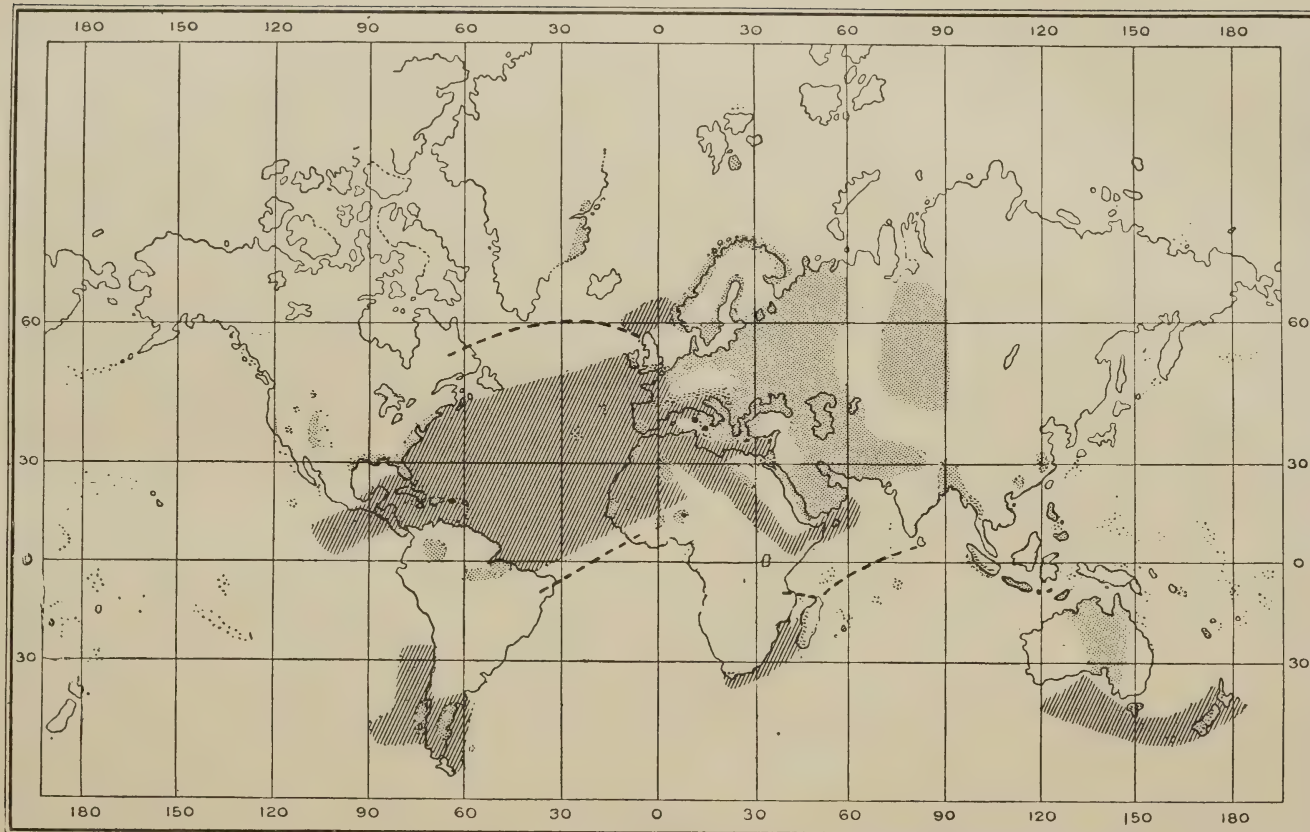
The earliest mammals are found in the uppermost Triassic rocks of England, Germany and North Carolina. They were marsupial forms. They occur later in considerable quantities in the Jurassic rocks of England and of the United States (chiefly Wyoming). These latter (Jurassic) beds contain remains also of an inferior order of mammals, the Monotremes. It will thus be seen that the less advanced order was the later in appearing, so far as the geological record can show at present.

The Marsupials do not seem to have relinquished their footing in Europe rapidly, where their latest occurrence is in the Oligocene beds of Hampshire and France. They are then found in the Miocene and Pliocene of Patagonia; and in the Pleistocene deposits in the last-named country, as well as in North America and Australia. They are limited to-day to America and Australasia.

The Monotremes, which now exist in New Guinea, Australia and Tasmania, continued from the Jurassic of England and Wyoming, where they first appeared, into the Cretaceous of those countries; they then spread to the Eocene of France and Puerco (United States). They are next discovered in the Pleistocene of Australia.

The Placental mammals are first found in the Lower Eocene beds of Europe and the United States. The earliest forms appear to be of types which have been called "generalised," for the reason that they possess characters which subsequently appear in more than one order of their successors. For instance, the Camels, the Chevrotains and the true Ruminants are descended from generalised

CHART V.



SEA IN TERTIARY TIME.

Shaded portions denote known seas. Diagonal portions denote probable seas.

Broken lines, probable land connections.

ancestors found in the middle Eocene of Europe and North America. These generalised types are found in considerable numbers, the animals possessing such well-differentiated characteristics that they must have been in existence for some considerable time before the Eocene period. As their predecessors have not been found we thus see another instance of the fact that the place of origin of life-forms has not yet been discovered. The fact that the generalised types referred to, buried as they were on the fringe of the Northern Continent, must have lived on that continent, points to that area, or some spot still further to the north which was connected with the North Atlantic land, as the country of of their origin.

The Camel family has two main branches, to one of which belong the Camels of the Old World, to the other the Llamas of the New. Camels have been found in the Pliocene of Roumania, Russia, Algeria and the Siwaliks. Llamas occur in South America as far back as Pliocene times.

The Chevrotain family, found in the Miocene of Sansan (France), is represented by a branch having members now living in Ceylon, India and the Malay Peninsula and Archipelago, and a branch inhabiting West Africa.

The section of the Ruminants first appears in the Miocene of Europe, subsequently differentiating into various families. Of these the antlered ruminants occur in the middle Miocene of France and Germany, whence they have spread through Europe, America, as far south as Chili, Asia and North Africa. The Giraffe family is first found in the Pliocene of France, Greece, Samos, Persia, the Siwaliks and North Africa; the modern members are the Giraffe and the Okapi of Africa.

The hollow-horned ruminants (*Bovidæ*) are first found in the Miocene of Europe, and are now distributed all over temperate North America, Europe, Asia and Africa. Of the Antelopes there are now only two species each in Europe and America, while in Africa they are numerous, as well as in Asia. They occur also in Japan, Formosa and Sumatra.

The three sections of animals referred to above are grouped together as pair-hoofed Ungulates.

Space will not allow of a description of the origin of each of the orders and suborders of placentals, but as examples of the dispersion of these animals one or two further instances may be mentioned.

Of the odd-hoofed Ungulates only three families are represented

at the present day. Generalised types of this order extend back to the Lower Eocene of Europe and the Upper Eocene of the United States.

One of the families, the Tapirs, is represented in the Upper Miocene of France by the genus *Tapirus*, which exists almost unchanged to-day in Central and South America, and in the Malay Peninsula, Borneo and Sumatra. The second family, the Horses, can be traced back to certain forms with five toes in the Eocene of the United States, the modern form dates from the Pleistocene of America and Europe. The horse became extinct in America, where it was restocked by the Spaniards.

The third family includes the Rhinoceros, whose ancestors existed in Europe and North America in the Lower Miocene period. They died out in America in the Pliocene period. Although at one time ranging throughout Europe and Asia, in the present day the rhinoceros is found only in Africa, India, Burmah, Malay Peninsula, Java, Sumatra and Borneo.

The Edentata of America have been traced back to certain forms of the Eocene of North America. Though these forms possessed incisors and rooted cheek-teeth, these structures were gradually eliminated more or less in subsequent fossil forms, so that now the ant-eaters have no teeth, while the dentition of other families is varied. The modern forms are found only in America south of Texas. The animals of the Old World formerly assigned to this order have been separated under a new name. Of these there are two families, one, toothless after birth, is found in Africa (East, West and South), India, Burmah, Siam, Cochin China, Japan, Malay Peninsula and Archipelago (greater part), and Ceylon. The other family is found in Africa only ; most of the teeth possessed by this family are preceded by milk teeth. These forms can be traced back to others in the Oligocene of France, Miocene of Germany and Greece, Lower Pliocene of Samos and Persia, and Pleistocene of Madagascar.

True Carnivora are first found in the Lower Eocene of France and of the United States (Puerco). These early forms became differentiated, and are now represented by the Cats, the Dogs, and the Bears.

The Cats date back to the Upper Miocene of Europe and North America. They are now distributed all over the world, excepting Madagascar and Australia.

The Dogs first appeared in the Oligocene of France and Lower Miocene of the United States. They have since spread all over the world, including Australia.

The Bears commenced in the Oligocene of France, whence they spread to Europe, Asia, and North America.

A word regarding the Primates. The earliest known forms are the Lemurs. The earliest forms attributed to this suborder are from the Eocene of France and the United States, where they continued up to the Lower Miocene; they have not been found in subsequent deposits until the recent superficial deposits of Madagascar. At the present day their principal home is Madagascar; they also inhabit Africa, Ceylon, Sumatra, Java, Borneo, Celebes, South-eastern Asia, and the Philippines.

The Primates of South America form a group by themselves, without representatives in the Old World. The only fossil representatives belong to one of the two families constituting the group; they have been found in the Patagonian Pliocene and in the Miocene of North America. That they did not originate in Patagonia is shown by the absence of lemurs from the South American deposits.

The Apes of the Old World do not extend into America. Their earliest fossil representatives are from the Miocene of Würtemburg, Tuscany and France; they occur in the Lower Pliocene of Greece, and in the Pliocene of England, France, Italy, and the Siwaliks of India.

The Anthropoid Apes are first found in the Miocene of France, Swabia and Switzerland, the fossil remains being considered to resemble the gibbon. The chimpanzee and the ourang have been found in the Siwaliks (Pliocene). The present distribution is—gibbons, Eastern Himalayas, South-eastern Asia and Sumatra; ourang, Borneo and Sumatra; the gorilla, West of Africa; chimpanzee, Africa, from the West Coast to the region of the Great Lakes.

It was mentioned in a previous article (p. 85) that Quatrefages[1] traced man back to the Miocene period. Gaudry suggests that the flint implements found at Thénay, on which Quatrefages based his arguments,[2] were produced by the anthropoid ape (*Dryopithecus Fontani*), whose remains are noted above as occurring in the Miocene of France.

Cursory as is this sketch, it furnishes sufficient material to indicate that the larger life-forms have spread from a single land

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[1] "The Human Species," International Science Series, p. 151.

[2] Joly, "Man before Metals," International Science Series, 1883, pp. 177 *et seq.*

area as opportunities have presented themselves. But this land area does not present us with a complete gradational series of forms; it merely gives us the earliest record yet discovered, and the one which most closely approximates completeness. It gives us sufficient to show that we must search further if we wish to complete the evidence necessary to obtain ocular proof of all the stages of the evolution of the main stocks, from which life-forms of the present day are descended. By adhering to the doctrine of descent from pre-existing forms we are driven, by a study of the distribution of species in the past, as well as in the present, to the Northern Continent, as that which, by the possession of the most complete series of ancestral types, shows itself to be nearest to the locality of origin. Animals have arrived at places distant from the locality of origin at epochs later than those during which they originated, terrestrial animals being directed in their migrations by the presence of connecting tracts of land. Isolation of land areas has caused, naturally, isolation of the terrestrial types existing on them at the date of their becoming separated from the source of supply. Thus, when Australia was isolated at some time in the Tertiary period its mammalian fauna was practically entirely marsupial, with the exception of the dog and some mice, and, perhaps, the bandicoot, and has since remained so. New Zealand has a few degenerate birds, in addition to some members of the mouse family. Madagascar was cut off shortly after the lemurs arrived there. At a later date Ceylon became separated from Peninsular India. South America is a land of Edentates. Africa contains a fauna resembling that of Pikermi, in Greece, some representatives of which lingered in Thessaly in the days of Herodotus. This fauna spread down to South Africa as soon as the disappearance of the Saharan Sea permitted of access, though some South African animals undoubtedly reached that country *viâ* the land connecting Ceylon and Madagascar and the East Coast.

These isolated areas present us with pictures of the fauna of epochs which in the North belong to a remote past.

"All the individuals of the same species, and all the species of the same genus, or even higher group, are descended from common parents, and therefore, in however distant and isolated parts of the world they may now be found, they must, in the course of successive generations, have travelled from the same point to all the others."[1]

[1] C. Darwin, "Origin of Species," 1882, p. 406.

Since Darwin wrote "Origin of Species" further discoveries have borne out the truth of the principle therein enunciated. Nothing has since been discovered which can interfere with the truth of the doctrine of evolution, of descent with modification. What has been the initiating and guiding force which has caused and maintained that evolution has been the subject of much controversy, a certain amount of which has been due to failure to accord a liberal recognition to the principles of Darwin's and Wallace's theory.

Darwin propounded the fact that variability is responsible for the initiation of new varieties and subsequent species, genera, and higher groups. This variability is called into play by new conditions of life, necessitated by the struggle for existence. "Favourable variations" only are accumulated. But the value of the word favourable is an important qualification. Darwin means favourable to continued existence; for instance, the mole having acquired burrowing habits and resultant blindness, has acquired characteristics favourable to its degenerate mode of life. Variability may lead to degeneration.

The different types of animals as they have spread from the source of origin have undergone modification, through the power of adapting themselves to the exigencies of their surroundings. This we can see for ourselves in almost every family which we have been able to trace from the Northern Continent. The members of any family by the time they have arrived at a distant locality have differentiated into different genera, or species, or perhaps only varieties. Animals do not migrate through love of travel. They only do so under pressure—the pressure occasioned by competition for the necessaries of life, or by the necessity for the avoidance of predatory types.

Hence it follows that the weaker migrate. But, in addition to that the mere fact of migration must lead to variation, apart from causes which, similar to those in their original home, stimulate variation. The power to maintain the struggle for existence while continuing unchanged must be regarded as the highest attribute to which any animal could aspire, for it would indicate an organisation perfectly adapted to its surroundings, undamaged by adverse influences. Any failure to hold its own with its fellows entails disappearance or modification of the individual or group. Modification leads to specialisation, and specialisation confirms new habits, which again must become perfectly adapted to what is required to maintain the animal in the new phase it has assumed.

Failure in the least respect entails a repetition of the alternative between extinction and renewed variation, either of body or habitat, or both. It is obvious, therefore, that adaptability or variability is essential to the preservation of life-forms which are getting the worst of it in the struggle for existence; the life-form is preserved at the expense of modification of the type. Variation is the index of the inability of certain members of a family to maintain themselves when in competition with other forms. For instance, the animal which can preserve itself only by changing its colour is on the road to extinction—it is marked down as the prey of others. The beast of prey whose size diminishes in order that he may be less visible to his quarry is on the path to extinction, as he will fall a victim to larger beasts.

We can imagine the centrifugal process of dispersion taking place through long ages leading to the distribution over the earth of the weaker, and to renewed weeding out at each stage of the journey, until the types arrived at a limit beyond which they could not travel on land. The weaker must then have been forced to burrow or swim. Those that could not find a subterfuge disappeared.

But not only have life-forms spread, and varied while spreading, from their original home, but new forms have arisen, these being advances on improved lines in the development of the original stock. "Old forms are supplanted by new and improved forms."[1] We have seen in the course of this sketch the sudden appearance on the scene of forms possessed of entirely new characters, and we have been unable to find intermediate forms showing the gradual growth of the new characters. Such may be forthcoming in time. For instance, it has not long been known that the bandicoot (*perameles*) has a rudimentary placenta which places it on the borderland between marsupials and placentals. It may be a degenerate placental. But if not, the appearance of new characters of such a type are on a different plane to the degeneration of a five-toed limb into a one-toed, as in the case of the horse. Here we have the principle of mutation, as enunciated by de Vries, to point out that species spontaneously produce well-marked stable varieties which breed true. These come under Darwin's category of "variations which seem to us in our ignorance to arise spontaneously."[2] Certainly it is not known why such mutations occur, but that they do occur is sufficient to account for the appearance of new types, while the absence of their immediate ancestors can only be

[1] Darwin, *op. cit.*, p. 417. [2] *Op. cit.*, p. 421.

explained by the fact that we have not yet discovered the site where such forms arose. The discovery of such a site will give us the missing forms, "only four or five progenitors,"[1] required to complete the chain of descent, or ascent, from the dust.

But in considering the progressive and the degenerate forms a further result becomes apparent.

Those dispersed life-forms that have arrived at the *ultima Thule* are weaker than those at the starting point, however robust they may on the surface appear to be. New Zealand possesses a luxuriant flora of an Old World type, which is being driven out by imported weeds. This fact is more evident to-day than when Darwin wrote: "It is said that the common Norway rat, in the short space of two years, annihilated in this northern end of the island the New Zealand species. In many places I noticed several sorts of weeds, which, like the rats, I was forced to own as countrymen. A leek has over-run whole districts, and will prove very troublesome, but it was imported as a favour by a French vessel. The common dock is also widely disseminated, and will, I fear, for ever remain a proof of the rascality of an Englishman, who sold the seeds for those of the tobacco plant."[2] This evidence of the extirpation of indigenous flora and fauna in the South by] forms imported from the North is but a corroboration of the truth of the principle enunciated above, that the types which maintain themselves within the area of their origin (or perhaps, as we do not exactly know the area of origin, we should say, nearer the area of origin) are more robust than those which disperse. Reason would lead us, in view of the theory, to anticipate a result which observation has shown to have occurred, and not only in New Zealand, not only with regard to plants, but also to mammals, as in the case of the Norway rat, quoted above, and of the rabbit in Australia, and the modern horse in America. These last are not actively offensive forms; but if we were to introduce into Australia a collection of European mammals, male and female of each species, maintaining at least for a period a sufficient supply of fresh blood from the parent stock, we might confidently predict the ultimate disappearance, in the course of time, of the marsupials and monotremes.

Man also is not exempt from the law, as witness the melting away, in the presence of European races, of the aborigines of the

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[1] *Op. cit.*, p. 424.

[2] "Voyage of the 'Beagle,'" Edition 1896, p. 513.

lands of the Pacific—a disappearance which is a "law of Nature," and one which no legislation short of the removal of the white man can stem. The confines of the world stand to animal life in the same relation as the lion's lair in the fable, regarding which the fox observed: "*Vestigia omnia adversum, mulla retrorsum video.*"

Other instances occur nearer home, where the red-legged partridge in some localities ousts the indigenous type; the Norway rat is driving out the long-tailed rat; the English sparrow is driving out other members of his tribe in North America.[1]

The whole scheme of distribution points to the same principle—the origin of parent stocks in some locality in the North; the dispersal of species from the same direction, in the first place by the driving out of the weaker members of an order to other localities where they can exist without pressure from their stronger comrades, provided they can adapt themselves to their new surroundings. In the second place by the expulsion of an old-established order by an order which newly appears on the scene, as in the case of the displacement of the reptiles by the marsupials, and of the marsupials by the placentals. The latter process, completed in Europe, is in progress in South America, and has scarcely begun in Australia. And thus we gain a reply to some of the propositions set forth on page 229 of this volume of the Journal.

We do not find a wide-spread origination of life with its subsequent development into higher forms in localities scattered over the earth, but we do find on the margins of the old North Atlantic continent a series of life-forms increasing in the scale of development, as represented by successive waves of higher forms, each more advanced than the preceding. This condition indicates that the old continent was itself, or was in close contact with, a locality where the origination of life was in progress, and from this continent the rest of the world was supplied with life-forms.

With regard to the proposition as to the formation *de novo* of protoplasm under favourable conditions from not-living matter in the present day, we have no ocular demonstration of its occurrence; neither do we see living transitional life-forms linking together the types. For if life were still originating from not-living matter, it must have done so continuously from the date

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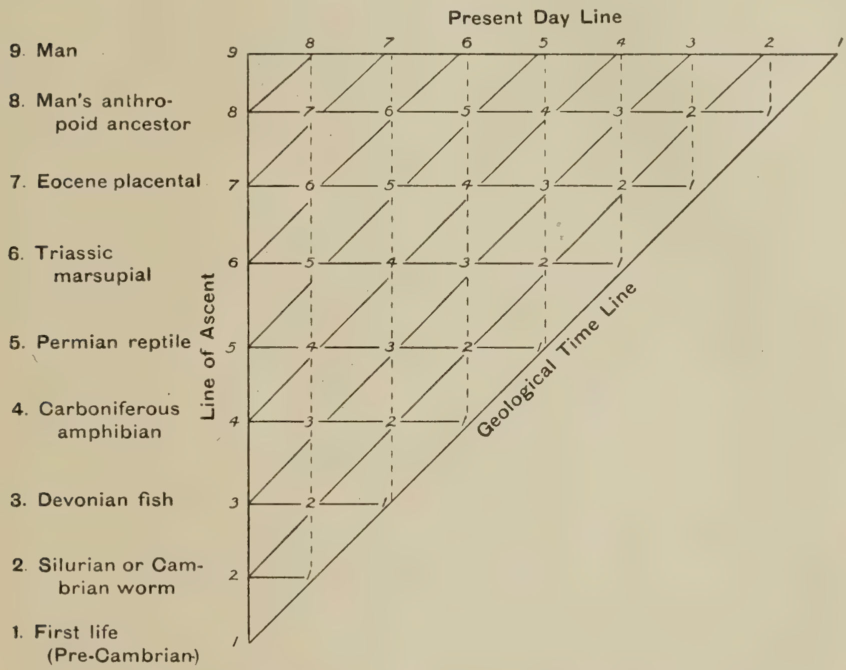
[1] For further instances see Darwin, "Origin of Species," p. 59.

of its first appearance; it must further have gone through and be still going through processes of evolution on lines similar throughout all time. The result, both in the past and to-day, of such a process may be graphically represented by the following diagram:—



The lowest diagonal in the diagram represents a supposed continuous origination of life throughout geological time; along this line certain points are selected and marked 1, the column of figures above indicating the stage reached at certain periods in the dotted line of ascent.

A few of the leading stages in the evolution of man have here been represented to show how those stages would be to-day visible on the earth's surface, together with their intermediate links. Such stages and intermediate links are not present. We have had to dig for them, with as yet incomplete success.

We are forced therefore to conclude that there was one main line of descent, from which branches diverged through "variation," branches whose variation led in many cases to extinction—these branches are not represented in the diagram.

If living matter, therefore, were still forming from not-living matter, we should see among the living things of to-day every

stage of evolution, not only among microscopic plants and animals, but also among the larger living things. We should be in possession, in the present, of all the "generalised types," which preceded every phylum, every class, order, family or genus of every form of living thing, and we should be lost in a maze of the wildest bewilderment among the interminable variations of life-forms.

We should not be content to imagine that under the microscope from "aggregates of bacteria, by common consent regarded as belonging to the vegetable kingdom, we have the production of typical animal organisms,"[1] while we cannot see the natural corollary to such a condition, namely the extension of the same process to larger life-forms. Though we may witness mutation in species, we cannot place such a change as the genesis of an animal from a microbe in the category of mutations.

The study we have just completed shows us that though new varieties and even species are still being evolved, the process of origination of life is a thing of the past. The poets may sing—

> And what is so rare as a day in June?
> Then, if ever, come perfect days;
> Then Heaven tries earth if it be in tune,
> And over it softly her warm ear lays;
> Whether we look, or whether we listen,
> We hear life murmur, or see it glisten;
> Every clod feels a stir of might,
> An instinct within it that reaches and towers,
> And, groping blindly above it for light,
> Climbs to a soul in grass and flowers.[2]

But beautiful ideas cannot convince against knowledge.

We can see types becoming modified, especially under domestication; we can witness the conquest of the weaker with its consequent disappearance of species, but the whole of the sciences bear out the truth that the period of origination is past on this earth. Living matter has been launched on its career, and from parent to offspring must carry out its destiny subject to the tendency it has always possessed, the tendency to vary. But we cannot see, and we shall never see, its origination from the soil. We men of the present day may be generalised types of the creatures that are to be, but even of this our evidence is more of the nature of presumption than of science, seeing that the generalised type from which it may be presumed we sprang

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[1] Charlton Bastian, *Nature*, vol. lxxi., p. 81, November 24th, 1904.

[2] J. R. Lowell, "Vision of Sir Launfal."

has not been discovered. We accept it as in keeping with the philosophy of evolution which leads us to the soil. Huxley's philosophical faith agreed with the writer of Genesis that man was formed out of the dust; the process was a thing of the past —"It can no more occur again."

So soon as that fact is finally accepted, the energies of the workers can be directed to a practical solution of the problem as to the locality where life arose. The vast collection of fossil forms point in one direction. The earliest known forms have been tracked to the northern land which lay between North-western Europe and North-eastern America. The labours of geologists and palæontologists have chiefly been confined to portions of the southern margins of that land; it remains to work out the deposits of the North, to lay bare the secrets of its northern fringe, and to correlate accurately the time origins of the northern strata with the strata further south. By working through the southern countries of the world we have seen by the distribution of *Amphibia* and Reptiles that the Trias of Germany preceded the Trias of the South (Africa, &c.); we must be prepared to acknowledge that the so-called Trias of Spitzbergen, where "it is easier to find vertebræ of a gigantic lizard of the Trias than bones of a self-dead seal"[1] is older than that of Germany; and we must be prepared to see that the so-called Cretaceous and Tertiary flora of Greenland may be older than the southern Cretaceous and Tertiary flora respectively. And still more, we must even be prepared to find the flora from which the plants composing the Pre-Cambrian Graphite beds were formed; we may look forward to finding the source of those Carboniferous plants (*Glossopteris*, &c.) which occur in the Carboniferous rocks of Australia, South Africa and India, &c., and which may have travelled from the North by a land route whose position has not yet been mapped out.

So far as knowledge has gone, she points to the North as the locality of origin. As to the source of life we have no actual knowledge, further than that of the biologist, who has proved that to-day there is no life without precedent life; knowledge which is verified by the above sketch, setting forth the progression, in the past only, of life-forms from forms low in the scale up to the Primates, preserved on or near the Northern Continent. Truly, many gradations are missing, but this is the only region which furnishes a record approaching such completeness as to

[1] Nordenskiold, "Voyage of the 'Vega,'" p. 323.

justify the theory of evolution by a fairly continuous chain of facts. Other regions do not present such records. Any theory which would suggest separate areas for the origin of life would require for its support a complete series of life-forms in each area, and such a series does not exist in any other area than that indicated above. We know that there was a remote past when the earth was lifeless; in that remote past not-living matter became living. We know this because we can trace back all life-forms to non-differentiated masses of protoplasm, which must have arisen from a protoplasmic slime produced from materials composing the earth's surface. Though there is no other thing from which it could have arisen, we hesitate to accept, except as "philosophic faith," the fact that the first protoplasm arose from the chemical constituents of the earth. Such faith is a paradox resembling the definition by a Biblical writer, "Faith is the evidence of things not seen," a *jeu de mots*.

Gravity is not seen; we call it a law because we observe its working. Its working is the evidence. It is not held to be a matter of faith. Abiogenesis is not seen; that it worked once is as patent as the working of gravity; but we do not call it a law because we are hampered with traditional views of Genesis—traditions handed down since the childhood of our race, dependent not on the dictum of the Biblical account of Genesis, but on the interpretation of that dictum. If before reading the Biblical account we had absorbed Darwinism, we should accept the origin of life from not-living matter as an essential, and call abiogenesis a natural law. We should then find that it was not a matter of faith—philosophical or unphilosophical—to accept the Biblical account of Genesis; but we should be filled with amazement that the writers of that account possessed a knowledge of the beginning of things so closely in accord with the knowledge acquired by us, practically within the last century. Further, we might be inclined to think that when our knowledge is more complete the differences between the earliest record and the latest will not be so vast as to be of material importance.

Reviews.

Report on the Sanitation and Anti-Malarial Measures in Practice at Bathurst, Conakry and Freetown. Memoir XIV., Liverpool School of Tropical Medicine, February, 1905. By Rupert Boyce, F.R.S., Arthur Evans, and H. Herbert Clarke. (Williams and Norgate, for the University Press of Liverpool.)

The introduction (in which, by the way, the first visit of Ross and Annett to Sierra Leone is erroneously dated 1889 instead of 1899) tells us that the object of the expedition was to make an "investigation as to how far the teaching of Ross was accepted and acted upon, and if it could be said that as a result of anti-mosquito measures and sanitation during the last four years, there had been a noticeable improvement in health."

The authors, we believe, spent a fortnight in West Africa, and most of that in Sierra Leone, Bathurst and Conakry being ports of call for the steamer on the way. The observers must have come to rather hasty conclusions. The Memoir, indeed, seems to have been compiled largely from reports of people on the Coast. Nevertheless, instruction is boldly given to coasters of all classes, as to how they are to conduct their social and sanitary affairs. It might be gathered from a perusal of the introduction alone, that sanitation on the Coast began with the arrival of Major Ross. Ross's great discovery, no doubt, gave an impetus to anti-mosquito work, but when he paid his first visit to Sierra Leone he failed to find any Anopheles' breeding places in the barrack grounds. The water supply, drains, latrines and buildings on Tower Hill and Mount Aureol—concerning which the authors say, "The sites appear to us to be excellent. The Military Hospital at Mount Aureol appears to us, both on account of its situation and sanitation, to be a model of its kind"—were the same as they are now. The sanitary arrangements of Freetown were not worse than those of some places in the British Isles. There were free hospitals, dispensaries, &c., not existing precariously on the donations of charitable persons, but paid for by the Government of the Colony.

The report gives a brief account of the sanitary practice in vogue in each of the three colonies; as well as notes on the climate, recreations, dwellings, diseases, social life, &c. The members of the expedition are struck with admiration of gay, boulevarded, French Conakry, in contrast to Sierra Leone; but they have to admit that, notwithstanding its natural advantages and the absence of cesspits, Conakry is unhealthy. French colonies are apt to be beautiful and expensive. English colonies pay their own way and grow, out of nothing. Conakry is small, new and European. Sierra Leone was established over a century ago as a settlement for civilised negroes—it is a black man's town.

The authors have had their denunciation of cesspits printed in large, black type. In their eager advocacy of pails they have fallen into traps. For example, we read that the rarity of dysentery at Conakry is "no doubt owing to the excellent water supply." Such a confident statement is not warranted by the facts. This part of the Coast is not a dysentery

country. Even in cesspitted Sierra Leone, before the new pipe-water supply came into use, there was little dysentery. During the war in the unhealthy hinterland in 1898-9, the troops campaigned in great discomfort through the rainy as well as through the dry season. They occupied native towns and drank unfiltered, unboiled water from various sources, yet there was scarcely any dysentery (see Army Medical Annual Report for 1898, p. 475, Major G. Wilson, S.M.O.: "Dysentery and diarrhœa were not at all prevalent").

The first view on Plate V. is misleading, partly owing to its small size. The vegetation in the foreground is half a mile from Freetown; the "dense vegetation" among the houses is an optical illusion, due to seeing the tops of palm and other trees from above.

As regards anti-mosquito work, the authors claim improvement at Bathurst—figures are not given in support of this opinion. At Conakry there has been no decrease in malaria. At Sierra Leone the people "think" and have "become more careful." Again, "we think also that there is every justification for believing that the health of the Europeans has improved during the last few years. . . ." The only approach to a justification for the last statement, that we can find in the book, is the following extract of death-rates of Europeans from the excellent annual report of Dr. W. T. Prout, P.M.O., Sierra Leone:—

1891	25·6
1899	33·3
1900	55·5
1901	37·0
1902	18·5

We admit that there is a striking and suggestive drop in 1902, albeit the increase in 1900 over 1891 is greater. We are fully in accord with Major Ross in his efforts to improve the health of the Coast communities, and we are confident that, as a direct result of Ross's work, the public in the Tropics is gradually being educated up to better knowledge of the requirements of health, the newly occupied segregation town in Sierra Leone being a case in point. The freeing of Sierra Leone from Anopheles mosquitoes is a big undertaking. It required a bold man to attack it at all. We are all the more inclined to think it a pity to anticipate results —to claim them before they are due.

It has yet to be proved that diminution of sickness in the places mentioned has resulted from the special anti-malarial operations of the Liverpool School. Variations in the death-rate of a small population are bound to be wide. In Dr. Prout's report, for instance, the same 1902 report from which the figures in the Memoir are taken, we find that *in* 1886 *there were no European deaths in Sierra Leone;* in 1887 there were only two and they were not climatic. The authors might well have quoted these figures to show that there were remarkably healthy years in Sierra Leone long before Ross made his discovery.

The summary contains a page and a half of advice, most of which sounds familiar. The Coast, indeed, has never been in lack of advisers, but the bricks have to be made without straw. The would-be benefactors of the defenceless little Crown colonies lose sight sometimes of the local conditions and the proportion of things generally. The writers of the Memoir, for instance, counsel extensive and expensive measures for Bathurst, a tiny place containing a hundred Europeans. The recommen-

dations for Sierra Leone include the converting of a few miles of small rivers or streams into drains by remaking the rocky beds. Inasmuch as the Government has already incurred very great expense in providing a segregation town for Europeans, and a railway thereto, a railway which will probably never pay, it seems rather early to ask it to plunge into debt by adopting extravagant schemes, in order to bring about doubtful benefit to the negro population which remains in the town. The Coast towns are poor. The negro is not keen on taxing himself for problematical blessings to posterity. The small white population is either official or is composed of traders or factory agents (factories so-called are not factories at all, but general stores for sale and barter). The traders or agents, styled merchants in the Memoir, are mostly mere employés of firms whose members live in Europe. The controllers of the purse strings are out of danger of malaria. If the wealthy members of firms, the shippers and the ship-owners who make their fortunes out of West Africa, would produce the money, their employés would soon be living amid good sanitary surroundings; so far most of the wealthy men have given very little except encouraging words. F. Smith.

Patent Foods and Patent Medicines. Two Lectures by Dr. R. Hutchison. John Bale, Sons and Danielsson, Ltd. Price 1s. net. 1904.

Dr. Hutchison has reprinted in pamphlet form two lectures delivered by him on the above subjects. Useful tables are given, showing the composition of a large number of food preparations, together with short general descriptions. The author is not an enthusiast as regards patent foods. "The ideal of an artificial or patent food would be a substance which was small in bulk, which contained in that small bulk the maximum of nutritious qualities, which was pleasant and stimulating to the appetite, which was easily digested, and which was cheap. That would be an ideal artificial food, and if ever that came to be invented it would be a substance which would rightly demand our support and recommendation. But unfortunately, the majority of artificial foods do not correspond to any one of those qualifications which I have set out." He then points out their chief defects, and shows that no more concentrated proteid food can be obtained than meat deprived of all its water (it being then practically pure proteid, 100 per cent.); if carbohydrate is wanted, nothing more concentrated can be wished for than sugar; and if fat is wanted, ordinary butter contains fully 80 per cent. pure fat. "So from the point of view of compactness, there are very few artificial foods which are superior to the natural foods." As to cost, Dr. Hutchison's opinion is, decidedly, that not one of them is worth the money asked for it, and some contain a ridicuously small amount of nourishment for the price: thus in ordinary meat we get 511 units of energy for a shilling, in Valentine's meat juice, 6 units for the same money. "A pound of honey costs 9d., a pound of malt extract costs 3 shillings, and the honey is the better source of sugar of the two." Now we know that for some meat essences it is claimed that they contain something like the equivalent of an ox in a small jar of the extract. Dr. Halliburton has told us that "instead of an ox in a teacup, the ox's urine in a teacup would be much nearer the fact, for the meat extract consists largely of products on the way to urea, which much

more nearly resemble in constitution the urine than they do the flesh of the ox." In spite of this we think that most practitioners believe, in their own minds, that there are cases in which these meat extracts are of the greatest benefit, a benefit so great that it justifies their existence, and even the apparently extravagant price asked for them. Neither Brand's Essence nor Valentine's Beef Juice come out at all favourably in the chemical analysis given; and yet, how many medical men must there not be who, having tried all sorts and descriptions of nourishment, have eventually found that one or other of these preparations (or others like them) has been retained, absorbed, and proved itself to be of inestimable value at a critical point; and notwithstanding the slight nutritive value present theoretically, worth more than anything else, in this particular instance, because retained and assimilated. Dr. Hutchison's pamphlet is extremely useful, and contains a large amount of information in a very small space. A. M. Davies.

The Effects of Tropical Light on White Men. By Major Chas. E. Woodruff, A.M., M.D., Surgeon, United States Army. Published by Rebman and Company, New York and London. Price 10s. 6d., net.

Under the title "Tropical Light," Major Woodruff, of the United States Army, discusses the influence of light generally upon the human race, a subject which he points out has not received a great amount of attention in medical literature, though it has recently been investigated by anthropologists. Among these, von Schmaedel, in 1895, showed that the "skin pigmentation of man was evolved for the purpose of excluding the dangerous actinic or short rays of light which destroy living protoplasm." With this for his text the author proceeds to discuss the physical properties of light, and their effects on the human organism. Short waves produce nervous paralysis and sunstroke, and increased tissue changes as measured by the amount of CO_2 given off by the body. They are inimical to bacteria. Retinal irritation is produced by excessive light. His next point is that animals prefer darkness to light—"the vast majority of land animals live in absolute darkness" (p. 65), "a day animal exists solely because its opaque armour keeps out the deadly arrows of light and the ultra-violet, by destroying them or reflecting them" (p. 66). Therefore, exclusion of light is desirable for man, who should live in dark cool houses: "We are the only people who have gone daft on the subject of admitting streams of powerful light into schoolrooms and nurseries" (p. 82.). The human animal's armour is his skin. A black skin will stop more violet rays than a brown, and a brown more than a white. Pigmentation of the human skin varies in direct proportion to the intensity of the light of the country to which man has become adapted by centuries of survival.

The position thus taken up leads to an examination of the distribution of the various races of men, both in the past and in the present. Primitive man was "brunette." First a long-headed "brunette" Mediterranean race occupied Europe, including Britain. Then a broad-headed Asiatic race invaded Europe. The origin of the "Blond" races is attributed to the pressure of invading populations driving the long-headed races northwards into Scandinavia, where under a cloudy climate they eliminated their skin pigment and developed into a "brainy" race. When their brains—stimulated to increase in size by the difficulties of

devising means of living and the consequent elimination of those whose brains were not large enough to assist them in surviving in the struggle for existence—had attained a size which has since placed the Blond man in the forefront of his fellows, this race of men surged over Europe, subduing the brunettes, and establishing itself at various epochs as the aristocracy of the countries wherein the bulk of the population continued brunette.

The varying fortunes attending the evolution and migrations of the Blond men occupy nearly 200 pages of the work, and form interesting reading. The author shows that England is not the home of the Blond man, modern statistics proving that the brunette is increasing in this country, partly owing to increase in town life, and partly owing to exhaustion of the Blond type after it has fulfilled its mission of educating the brunette in the ways of morality and good government. The home of the Blond is placed in the neighbourhood of the Baltic, whence he has spread to govern and to raise Egypt, Assyria, Greece, Rome, in fact every Empire, which has risen in its turn to the front rank, and whence America obtains still a constant supply to keep her stock fresh. These waves of conquest have in time exhausted themselves, owing to the inability of the Blonds to withstand the light conditions of the lands distant from their station of origin.

Major Woodruff's experience in the Philippines shows him that the Blond cannot stand the Tropics ; he illustrates this further by the distribution in America of pigmentation, varying with the temperature and light conditions. He does not believe in acclimatisation, but he considers that the ill-effects of too much light may be minimised by carrying out certain rules which are dealt with in the concluding chapter : we can "dodge the fatal factors."

The style of the work is unconventional. Technical phraseology is skilfully avoided. There is sometimes a condensation of trains of thought, evidently with a view to avoid burdening the general reader with too much detail; but this is at the risk of the reader not always carrying away a correct impression. For instance, on p. 63 we read "the lowest forms became adapted to terrestrial life by hardening of the exterior, *i.e.*, became crustaceans." Of course it is not intended to convey that hardening of the exterior produces crustaceans.

The therapeutic effects of light are touched upon, for Major Woodruff points out that though excessive light is prejudicial, carefully administered courses of treatment by light may be beneficial.

This portion of the work does not exhaust the subject of the therapeutic action of light. We hope, however, that the suggestions quoted from certain sources may stimulate work directed to afford exact knowledge as to the modifications produced by heat and light in the human body, and also as to the value of clothing of a particular colour—such as orange or red—in India and the Tropics generally.

While the book gives us some material for reflection, it also presents sometimes a humorous side to the question, as in the description (p. 293) quoted from a Washington lady setting forth the damaging effect of Colorado upon her complexion.

The index is not so complete as we could wish to find in a work embracing so wide a range of subjects bearing upon light.

Bruce Skinner.

Current Literature.

The Prophylaxis of Venereal Diseases in the Army.—Dr. Graujux, Editor of *Le Caducée*, after alluding to various articles on this subject in previous numbers of his journal, describes (*Le Caducée*, March 4th, 1905) a new plan of utilising a method which has hitherto yielded only poor results. The method is that of delivering lectures to the men on the consequences of venereal disease upon their health and that of their offspring. Graujux has done his best to explain hygienic rules and lay down moral precepts; but his efforts have merely shown the difficulty of engaging for an hour the attention of a body of men, more or less tired, unaccustomed to sit still and attend to a speaker, even when he adapts his talk to their understanding. The case is different when technical instruction is given to hospital attendants; the attention of a small body of men can be engaged for a sufficiently long time, especially when one or other is directly addressed. The futility of lectures, unless to a small audience, has been proved by experience in a dragoon regiment at Vincennes.

Last year, the regimental surgeon lectured on the "Dangers of Syphilis" to each squadron, with the result that many cases, previously concealed, were admitted into hospital. In the present year, the Colonel asked permission from the authorities to send a certain number of men to the Museum of the Hospital St. Louis, under the guidance of a medical officer charged to give them lessons based on pathological specimens. Permission was granted, and, after instruction in barracks on venereal diseases, twenty-five troopers were selected from each squadron for their intelligence and influence over their comrades. The explanations given by the medical officer were listened to with great interest. On returning to their mess, the 125 men were regarded with much curiosity. Convinced of the truth of the surgeon's statements, they tried to make their comrades share their convictions. The principal object was attained, and the following rule was adopted in the regiment: "Every man who has contracted venereal disease should at once report himself to the medical officer, in order to avoid the serious consequences of the malady."

Thus this regiment contains a band of individuals with pronounced views, and listened to with respect, while diffusing among their comrades a knowledge of the advantages of hygiene. A similar plan with regard to another matter has been found to work well in mines, and Graujux points out that, disagreeable as the admission may be, advice even on hygiene, while it may be *tolerated* from a superior, is nowadays *accepted* only from an equal.

T. P. Smith.

Treatment by Adrenalin of Conditions Resulting from Exposure to Solar Heat.—Surgeon-Major Sabatier (*Le Caducée*, March 4th) thinks that the treatment of sunstroke has not been much improved by modern discoveries. According to Hiller, a German Army Surgeon, the general indications are: (1) To restore breathing by artificial methods; (2) to

stimulate the heart's action by injections of caffeine, ether, or digitaline; (3) to eliminate the toxic products of malassimilation by bleeding and injections of artificial serum. All this is purely symptomatic treatment, and Sabatier asks whether the indications would not be more satisfactorily fulfilled by adrenalin. He proposes to treat such initial symptoms of sunstroke as profuse perspiration, headache, vertigo and a feeling of cerebral oppression, by hypodermic injections of 3 to 6 drops of a 1 in 1,000 solution of adrenalin, or by 5 to 15 drops by the mouth. When the symptoms are those of syncope or of asphyxia, he recommends the same drug, followed by intravenous injections, massage of the cardiac region, and artificial respiration. In short, adrenalin may be used with the object of restoring animation, at least in some degree, and of restraining profuse glandular secretion due to violent efforts or to distressing ordeals.

T. P. Smith.

A Case of Subcutaneous Fracture of the Skull, with Injury of the Middle Meningeal Artery.—Staff-Surgeon-Major Schmolling, of Posen, relates the following case (*D. Militärärztliche Zeitschrift*, February, 1905). On August 16th, 1903, at 6.30 a.m., a soldier was struck on the head with a zinc pail, by a comrade during a quarrel. He fell down unconscious, but soon got up and did stable duty for a quarter of a hour, the so-called "free interval." Giddiness set in, he reported himself sick at the office, went to bed, and again became unconscious; was brought to hospital at 11 o'clock, in the following condition: pupils much contracted, reacting slowly to light; no corneal reflex, pulse 44, hard, full; respirations 14; no visible or tangible injury of the head, till after it had been shaved, when a slight flattened swelling, about as large as a shilling, was found over the left parietal bone. Inasmuch as the three principal symptoms of cerebral compression, viz., the free interval, the infrequent pulse and respiration were ascertained to exist, the diagnosis was extravasation of blood between the bone and the dura mater. At noon the man was placed under chloroform, the integument was disinfected, and a flap of skin and periosteum made by an incision around the swelling (10 : 5 cm.), with its base just above the left auricle; the flap turned downwards. No fissure visible; blood freely exuding through the Haversian canals, indicative of exudation under great pressure. For its removal, the parietal bone was cut through with a chisel over an area of 7 × 5 cm.; a fracture 4 × 1·5 cm. discovered beneath the anterior border; bone extremely thin, measuring only 3 mm. The exposed hemispherical clot, 9 cm. in diameter, 3·5 cm. thick in the middle, and in volume about 250 ccm., was pressing upon the left hemisphere. Careful removal exposed two bleeding branches of the middle meningeal artery; these, with the attached parts of the dura, were seized with a tenaculum and tied. During the removal of the clot the cup-like cavity gradually diminished, the pulsating brain, relieved from pressure, rose towards the surface of the bone to which the uninjured dura became closely applied. The wound was loosely plugged with iodoform gauze, the flap replaced, two sutures applied, and the wound left open posteriorly. Over all, a sterilised mull dressing.

The result of the operation was very satisfactory. Soon after its completion the man became quite conscious; the pulse softer and more

frequent (rising from 44 to 60 and later to 70). All threatening symptoms disappeared, the man was cheerful and even merry, and made no complaint of pain; no fever observable. After twenty-four hours the outer saturated layers of dressing were replaced by dry sterilised mull-iodoform gauze, rather closely adherent to the fresh granulations, no trace of suppuration, sutures removed, the posterior longitudinal incision afterwards sutured; complete healing ensued with firm cicatrices. Pulsation of the brain distinctly felt and seen through the gap in the bone. Subsequently, an osteo-plastic operation was refused by the man, who was supplied with a protection-plate, and sent home as an invalid on October 26th.

The list of operations given in the Sanitary Reports of the Prussian Army and of the Saxon and Würtemberg Army Corps, for the last ten years, contains only seven cases of injuries similar to the above, and treated in a like manner. Of these, four were discharged cured or invalided to their homes, and three were fatal—a mortality of 43 per cent. Wissmann's statistics of 110 similar operations give 74 cures and 36 deaths, a mortality of only 32 per cent.

When the middle meningeal artery has been injured, the most urgent indication is to relieve the compressed brain. Undue postponement of the operation is to be deprecated, for the chances of success are diminished as time goes on, owing to danger of paralysis of the respiratory and circulatory centres. Under expectant treatment, life may be prolonged for two or three days, but an operation is then generally too late. Active treatment, speedily carried out, is the only reliable method. Unfortunately, there are many cases in which the operation is useless, and the end soon comes, being due to such complications as inaccessible hæmorrhage beneath the dura mater or at the base of the skull; extensive laceration of the brain, fractures at the base, and consequent meningo-encephalitis. Sometimes after an apparently successful operation the patients are carried off by broncho-pneumonia, due to the entrance into the air-passages of particles of food or saliva when the glottis is insensitive or paralysed. But in a case similar to the one described, the operation is likely to be as successful as tracheotomy or herniotomy.

T. P. Smith.

Pathology of Tropical Disease in Kamerun, West Africa.—(*a*) *Trypanosomiasis.*—In "*Beitrag zur Trypanosomenfrage*" (*Centralblatt für Bakteriologie*, Band xxxviii., 1905), Dr. Hans Zeiman gives an account of his researches on this subject in Kamerun. He states that he has found two apparently different trypanosoma infections there: (1) The tsetse-fly disease of South Africa, East Africa and Togo; (2) another infection apparently different from it, caused by a trypanosoma which he has named *T. vivax.* He differentiates it from *T. brucei* on the following grounds: (1) By the shape it more closely resembles *T. lewisi;* (2) by its greater mobility; (3) by its greater virulence; (4) difficulty in differentiating sexual forms in contradistinction to *T. brucei;* (5) by the variety of animals naturally affected. It chiefly affects oxen, sheep and goats among domestic animals. Laveran can find no morphological difference between it and *T. evansi.* Inoculated into dogs it produces a slight infection and the dog apparently recovers.

He is inclined to consider that this trypanosoma is conveyed by a

variety of Tabanus, probably *Chrysops dimidiatus*, V. d. Wulp. At Suella he made the following observation: all the animals in a herd there, that had trypanosomes in the blood were slaughtered. No fresh cases occurred in April, May, June, July or August, 1903; an investigation in October showed that nine out of twenty-three were affected by *T. vivax*. He explains this long interval by the hypothesis that the parasite undergoes a change in the fly and increases and infects the offspring of the fly. There is no proof that such a change takes place in the tsetse-fly, and in opposition, too, is the fact that Corporal Gibbons, R.A.M.C., whilst on the staff of the Sleeping Sickness Commission in Uganda, allowed a number of freshly hatched-out flies (*Glossina palpalis*) to bite him without any untoward result.

(*b*) *Filaria Infection.*—Dr. Zeiman (*Deutsche Med. Woch.*, 1905, No. 11) finds that 30 per cent. of the native population of Kamerun harbour filaria embryos in their blood, whilst only 1·6 per cent. of the white population harbour them. *Filaria perstans* is the common variety there. In three cases of *F. loa* in natives, he has noted the fact that with the disappearance of the worm from the eye, embryos having the appearance of *F. perstans* have appeared in the peripheral blood. He is inclined to regard the *F. loa* as the parent worm of *F. perstans*. Manson regards the *F. loa* as the mother worm of *F. diurna* embryos. Zeiman classes *F. diurna* and *nocturna* as *F. bancrofti*. At the height of the dry season in Kamerun the insects are few in number and the filaria infection is low. Dr. Zeiman has found a filaria in the blood of a chimpanzee. A filaria resembling the embryo of *F. demarquaii* was found by the Sleeping Sickness Commission in Uganda in a monkey. This discovery was attributed, wrongly, to Dr. Ross, in the *Journal of Tropical Medicine*, January 1st, 1904.

(*c*) *Distribution of Blood-sucking Insects in Kamerun.*—In "*Beitrag zur Verbreitung der blutsaugenden Tiere in West Afrika*" (*Archiv für Schiffs und Tropen Hygiene*, Bd. ix., 1905) Dr. Zeiman gives a list of Ixodidæ met with on various animals in West Africa, and the importance of making a collection of ticks and having them identified is emphasised. Since it is known that ticks convey not only parasites pathogenic to animals but also those pathogenic to man, it is very desirable that these collections should be made in the Tropics generally. As regards tsetse-flies the following are found: (1) *Glossina palpalis*, at several places, *e.g.*, Victoria, Buea and Barobi, sleeping sickness occurs; (2) *G. fusca;* (3) *G. tachinoides*, from Lake Chad, and it probably conveys the trypanosoma which causes the disease there.

E. D. W. Greig.

RETURN MEDICAL VISIT TO FRANCE.

It will be remembered that when the French physicians and surgeons visited London in November last they were accompanied by a medical officer of the French Army attached to the Ministry of War, to whom we were able to show some small civility. When the return visit was being arranged an invitation was received from France for representatives of the British Army Medical Services to join the party.

The invitation so cordially given was accepted by the Director-General in person, who was accompanied by two officers from Headquarters. The Royal Army Medical Corps was further represented by an officer recently retired.

It is altogether impossible to adequately describe the warmth of the reception. The elaborate preparations made by the medical profession in France for the welcome of their brethren from the British Isles have been described in the Press, but the spirit of enthusiasm and friendliness which everywhere characterised the proceedings lent them an additional significance. The reception was one worthy of a great people anxious to show its goodwill, and made an ineffaceable impression on those who had the good fortune to be guests.

Amongst the many greetings exchanged none were more friendly than those tendered by the medical officers of the French Army to their British military *confrères*.

An officer of the Headquarter Staff, Monsieur le Médecin-Principal Lacronique, was told off to look after us and to conduct us whithersoever we wished to go. Everywhere we were met and welcomed by highly placed and distinguished officers, every door was thrown open, every question answered.

It is difficult to express our appreciation of the kindness with which we were overwhelmed, more especially as the attentions lavished on us were not personal, but were evidently intended as a tribute of friendship from one service to its sister in our army.

Amongst those to whom we wish to express our special obligations are M. le Médecin-Inspecteur Delorme, Director of the Val de Grace, whose monumental work on military surgery is well known to us on this side of the Channel; M. le Médecin-Inspecteur Strauss, Principal Medical Officer of the Paris Garrison, who personally conducted us over the institutions in his charge, and which we were privileged to see; M. le

Médecin-Principal Chevassu, of the Hospital St. Mandé; M. le Médecin-Principal Chavasse, and others of the Staff of the Val de Grace.

The impression left upon us by the many military medical officers we met was that of a service devoted to its work, striving hard to maintain, at the highest pitch of excellence, its professional prestige, and succeeding in no small degree.

Our military hosts, in their anxiety to show us everything that could be of interest, took full toll of our time.

On the Thursday we were shown over the Military Medical School and Hospital at the Val de Grace; on Friday we were taken over the depôt of field medical *matériel* at Vanves, and Saturday was devoted to a visit to the Military Hospital at St. Mandé.

The Val de Grace combines the Military Medical School and a hospital of 1,100 beds. Originally constructed in the seventeenth century for a Benedictine monastery, by Anne of Austria, as a thank-offering for the birth of her son, Louis XIV., it was devoted to its present purpose in 1852, and received its first batch of probationers in 1853.

French military medical officers pass the first four years of their curriculum in the preparatory college affiliated to the University of Lyons. The candidates successful in the competitive examination at the close of that course, having taken the doctorate of the University, pass on to the Val de Grace to receive the military medical portion of their training.

Being already university graduates they enter the school as commissioned officers in the rank of aide-major of the second class, wearing the uniform and receiving the pay of their grade. They reside outside, coming to the college for their instruction. The course lasts ten months and is closed by a competitive examination, according to the result of which the officers take seniority amongst themselves. Each yearly class consists of some sixty to eighty officers. We had the good fortune to see the present class on their way to the riding school, and they struck us as being particularly smart, well turned out and set up.

Though the school and the hospital are two distinct institutions, they are so dovetailed into each other as to form but one establishment.

The present Director is M. Delorme, Médecin-Inspecteur (Member of the Academy of Medicine), and he is aided by a Deputy-Director, who is at the same time Principal Medical Officer of the hospital.

The physicians and surgeons of the hospital are professors in the school.

The teaching staff includes professors and assistant professors. The former, of whom there are seven (including one pharmaceutist) are selected from the past assistant professors and are nominated for ten years. The latter are chosen by competitive examination and hold office for five years.

The school is very completely equipped. It has a well-found library

and a richly stocked anatomical and pathological museum, the latter containing the admirable series of specimens of lesions caused by small calibre bullets collected and arranged with such skill by Monsieur Delorme, and which we had the good fortune to have demonstrated to us by himself.

Another feature of great interest was a collection of models of the various apparatus and improvisations used under war conditions by the Military Medical Service, which M. Delorme is now engaged in founding and developing. This museum is evidently a labour of love with him and will prove of the greatest educational value to the young officers. It is full of practical suggestions, and points to a gap in our educational equipment which it were well should be quickly filled.

Recently a historical museum of the Military Medical Service has been founded, which contains many interesting mementoes of the great Baron Larrey and other eminent medical officers, and a striking series of pictures of incidents memorable in the history of the Corps, painted by artists passing their year of service in the ranks of the infirmiers. Conscription is evidently not without its advantages.

At Vanves we were shown the Medical Field Equipment. M. Strauss, Médecin-Inspecteur, Principal Medical Officer of Paris, himself met us, attended by a number of other officers, and personally showed us the various articles of equipment. Among the more interesting articles were a portable stretcher support and mosquito net frame which have been found very useful, both the inventions of M. le Médecin-Inspecteur Strauss, and samples of the combined dressings which it is understood are to be adopted in the French Army.

On the Saturday morning M. le Médecin-Inspecteur Strauss again met us at St. Mandé, and personally showed us over the Military Hospital at that place. This is a comparatively modern building beautifully situated just outside the fortifications, in its own spacious well-kept grounds. The garden stretches away to the Parc de Vincennes, and the hospital is therefore in a particularly airy and open spot.

Everything was scrupulously clean, and it was evident that all equipment necessary for the efficient treatment of the sick was provided; M. le Médecin-Principal Chevassu, who is in charge of the hospital, took evident pride in it, as well he might.

By the kind permission of M. le Médecin-Inspecteur Strauss we were also enabled to visit the Regimental Infirmary of the Regiment of Dragoons stationed in the neighbouring barracks at Vincennes. An interesting observation made by the regimental surgeon and confirmed by M. le Médecin-Inspecteur Strauss, was that the introduction of compulsory shower-baths had practically abolished itch. We were shown the regimental shower-bath, a simple apparatus allowing of a heated shower-bath once a week for every man in the regiment, very

inexpensive and easy to work, and evidently very efficacious. The men bathe by squadrons and a careful register is kept to see that none escape.

I will only add a word in acknowledgment of the extraordinary kindness and cordiality of our reception, the memory of which will be abiding, and to express a hope that some of our military hosts or their brother officers may pay us a visit in our own country before long, where we can assure them of a hearty welcome.

M. W. R.

Correspondence.

PREPARATION FOR PREVENTION OF MOSQUITO BITES.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

DEAR SIR,—Like other people, I have been much bothered with mosquitoes and flies of sorts, on various expeditions in Iceland, the West Indies and the Nile. I have tried many applications to the skin to make myself unpalatable to them. Most of those recommended seemed to have no effect, and those which have some effect, such as paraffin and eucalyptus oil, required to be applied in such quantity to one's head and neck as to be practically unuseable. It has occurred to me, that probably there may exist some substance which, taken internally, would make one's body unattractive to the mosquitoes, and if you remember how one imbibes odours at a *post mortem* on a midwifery case, which make one's secretions smell for many hours afterwards, it seems possible that a very minute quantity might be sufficient. I mentioned the subject to Dr. Ringer, F.R.S., the author of the well-known book on therapeutics, and he said that a tincture prepared from the stings of bees had been mentioned to him, but he had had no personal experience of it, and he did not know where it could be got. I am taking the liberty of writing to you to ask whether you have any opinion on the subject? It would seem to be one on which it was worth making some observations by those who have the opportunity.

Yours truly,

17, *Stonegate*, *York*, *April* 24*th*, 1905. TEMPEST ANDERSON.

RAILWAY SANITATION.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

DEAR SIR,—Have any suggestions ever been made, or have any practical steps been taken, to put a stop to the very insanitary custom of allowing all excreta to be deposited by train on the railway lines? My experience of this practice in South Africa left very little doubt in my mind that enteric fever was spread through the blockhouse line by the ambulance and other trains conveying patients with this disease, and since my return to this country I see the same system is in use on every line I have travelled by. That this is a grave danger, I need hardly point out to you or any practical sanitarian.

One case alone of undiagnosed ambulatory enteric fever is enough to spread disease in any ordinary camp, take what precautions we can to prevent it, and the same, if allowed to travel by railway with a lavatory system as at present, may be the source of a wide epidemic.

Besides this form of enteric fever, we have the danger arising from convalescent cases, many of whom we know travelled by ordinary train in South Africa, and many of whom, I have no doubt, travel in this country long before the bacilli have disappeared from their urine. It would be interesting to have the opinion of other officers on this point.

Belfast, Yours truly,

March 25*th*, 1905. G. T. GOGGIN.

[I do not think it likely that enteric fever is ever spread in this way in this country. That it was a source of danger in South Africa I admit, but here conditions are very different. What practical substitute has Lieutenant-Colonel Goggin to offer?—T. McC.]

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